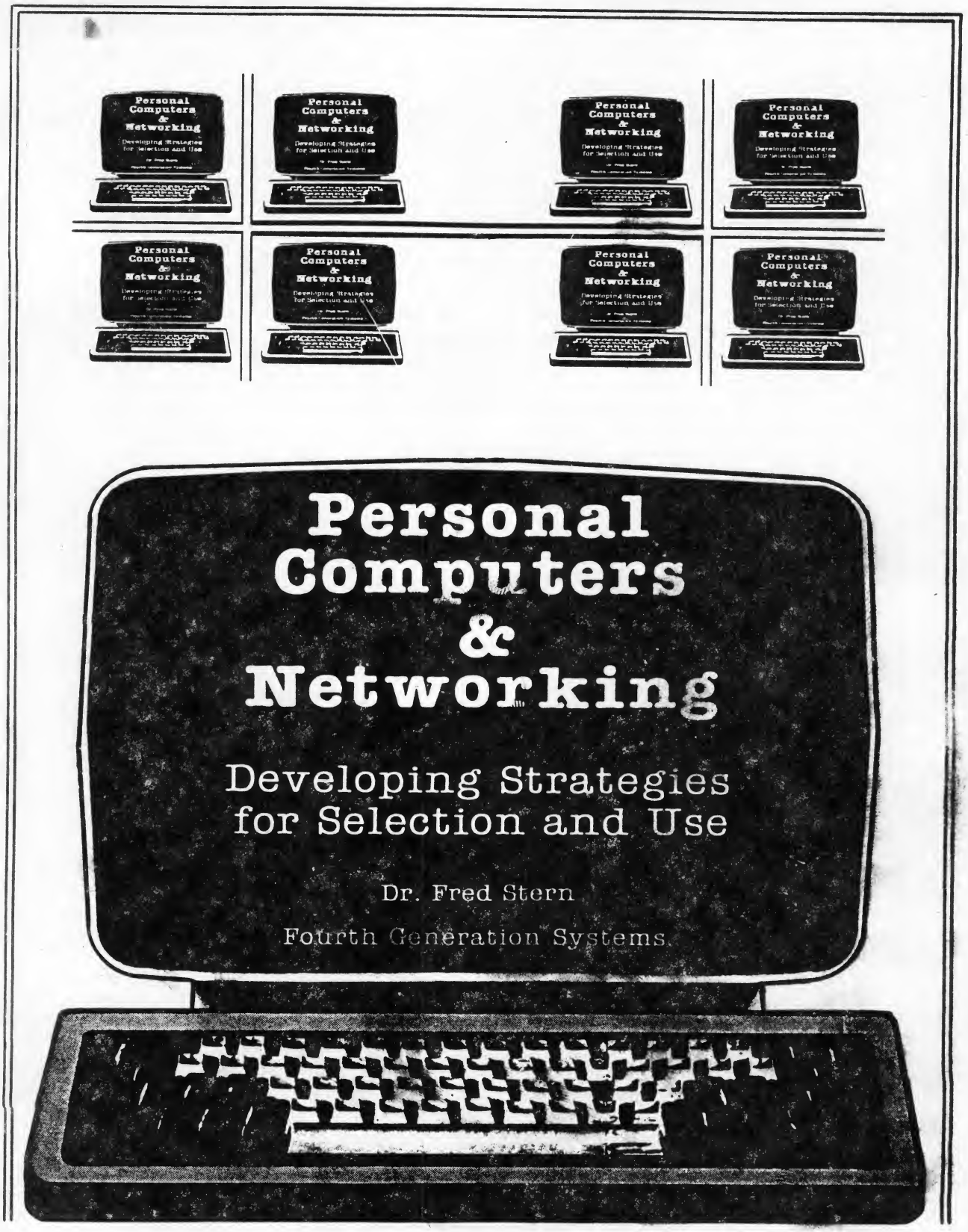
Personal Computers & Networking

Developing Strategies for Selection and Use

Dr. Fred Stern

Fourth Generation Systems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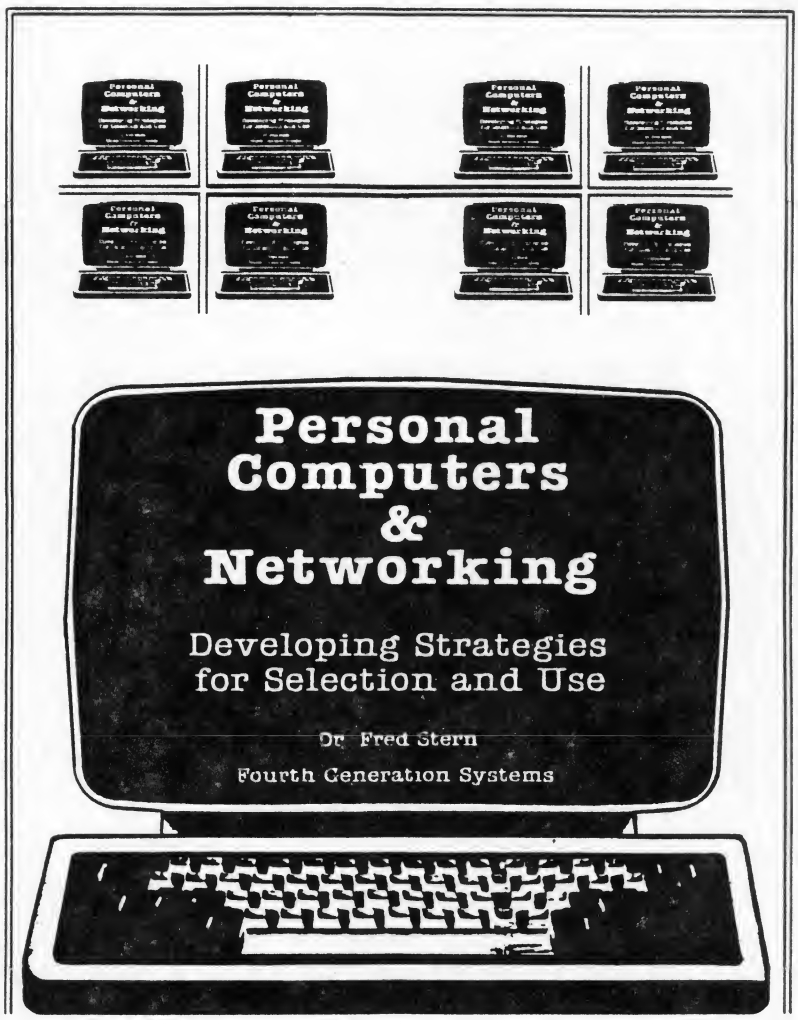
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Preface

This book is a workbook for a seminar on Personal Computers and Personal Computer Networking. The book and the seminar together present only an overview of a vast and rapidly changing field. Rather than an in depth technical presentation on each of 16 subjects, I attempted to present the critical information required to acquire, use, and formulate company policy regarding small-scale, low-cost computers.

I have included vendor information sheets to explain the relationship of vendor advertising to product selection. The materials chosen in no way represent an endorsement of the vendors or products. They were either actively solicited from vendors or represent vendor advertising. The inclusion of vendor materials is not meant to be a copyright infringement and I make no claims to these materials. All vendors contacted were enthusiastic about having their materials in the workbook.

Tables of vendor comparisons were abstracted and combined from the Data Pro Small Computer and Data Communications series, as well as from articles in Business Computer Systems, Popular Computing, High Technology, Byte Magazine, and PC World. Because competition among computer vendors is so fierce, the comparison tables are impossible to keep accurate and should be used only to represent the cost spectrum.

Copywritten material from Data Communications and Distributed Processing seminars by Uyless Black and Ken Sherman is included. I am deeply indebted to them both for their support and encouragement during the preparation of this book.

Fred Stern

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Section 1

Introduction

The Revolution:

You Can Have The Power Of A Large Main-frame Computer On Your Desk For A Few Thousand Dollars.

400 Main

The Evolution:

1946 - ENIAC

1952 - First Transistor

1960 - Integrated Circuit

1970 - I.C. Matrixing - LSI

1975 - MITS, IMSAI - FIRST MICRO CHIPS HOBBY UNITS

1978 - First Business Systems - MICRO'S FBIT

1980 - Fourth Generation Languages - SOFTWARE PACKAGES

1982 - Second Generation Micros - 16 BIT MICRO'S

Computer Literacy:

A Myth Propagated By Computer and Software Vendors

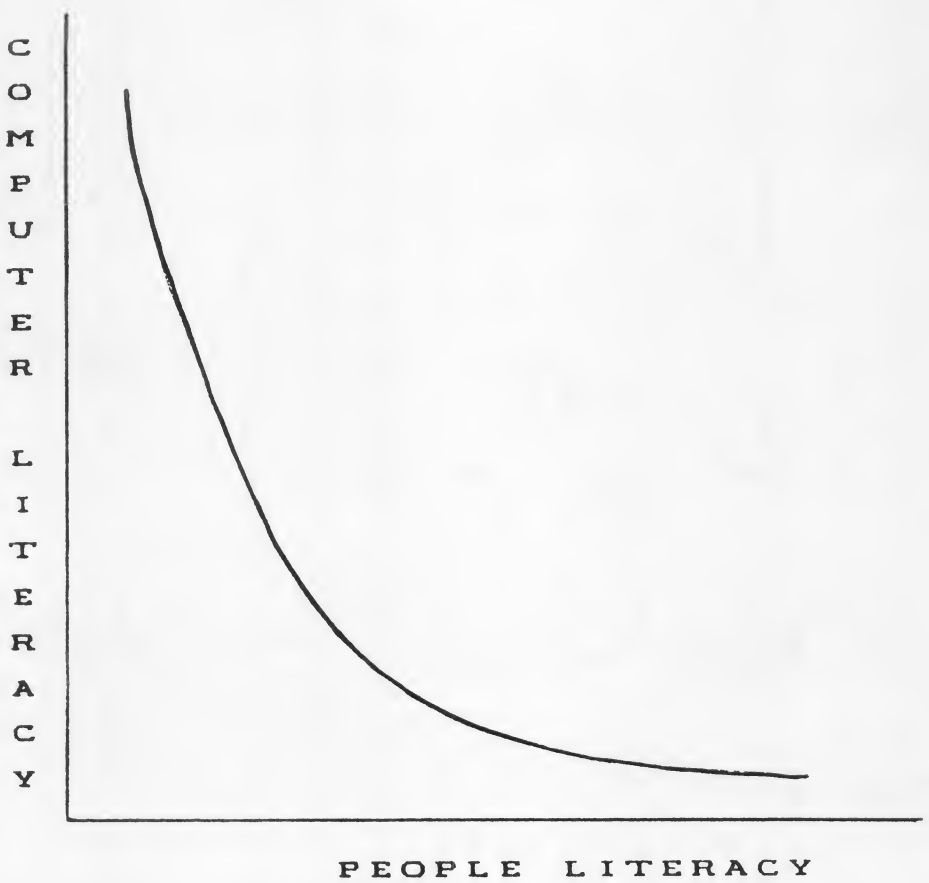
The Response:

If Machines Were Designed To Be People Literate There Would Be No Need For Computer Literacy!

Attributes of a Tool

- Easy to Learn and Use
- No Alteration of Work Style
- Accurate and Reliable
- Cost Effective

System Evolution



The Generations

1. Machine
2. Assembler
3. Application Oriented COBOL FORTRAN
4. Problem Oriented
5. Analytical Reasoning

Computer Languages

- Procedural (Step by Step)
- Requires Programming Knowledge
- Formula or Relationship Oriented

Fourth Generation Languages

- Non-Procedural
- Problem Orientation
- Self Teaching
- Real Time Interactive
- System as a Tool

Terminology

Computer a device capable of solving problems by

Accepting Information (input)
Performing operations on the input (process)
Presenting the results of the operations (output)

A Computer System consists of Physical Devices (Hardware) and Programmed Instructions (Software)

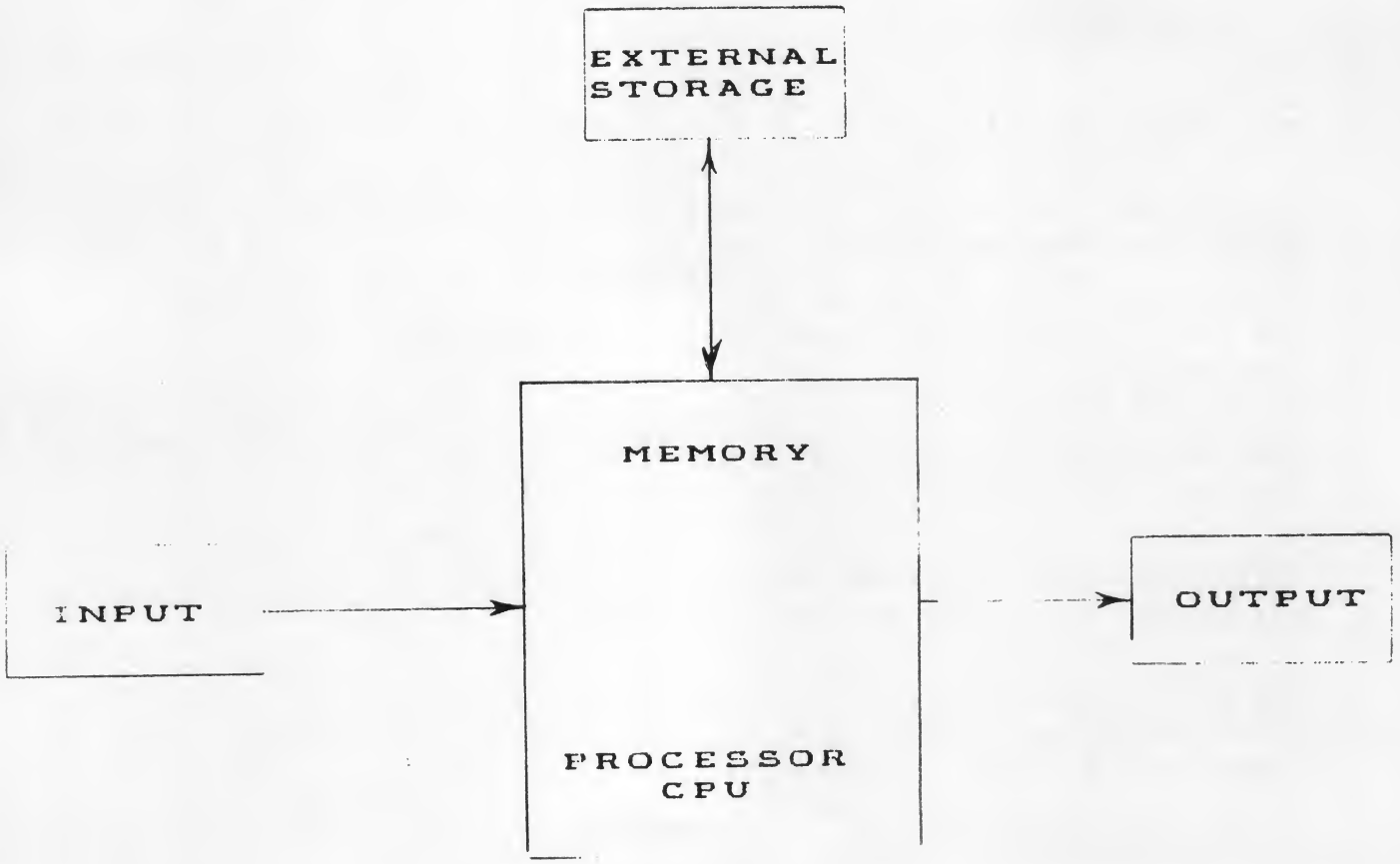
Input or Output Devices are called Peripherals

Memory - The Internal Storage Area for Programs and Information

External Storage - Usually a magnetic medium for permanent records.

CPU - The Central Processing Unit. The Computer Brain, The Controller.

A Computer System



Terminology

CRT- Cathode Ray Tube. A television like display screen

Keyboard- Standard typewriter looking device for hand entry of information.

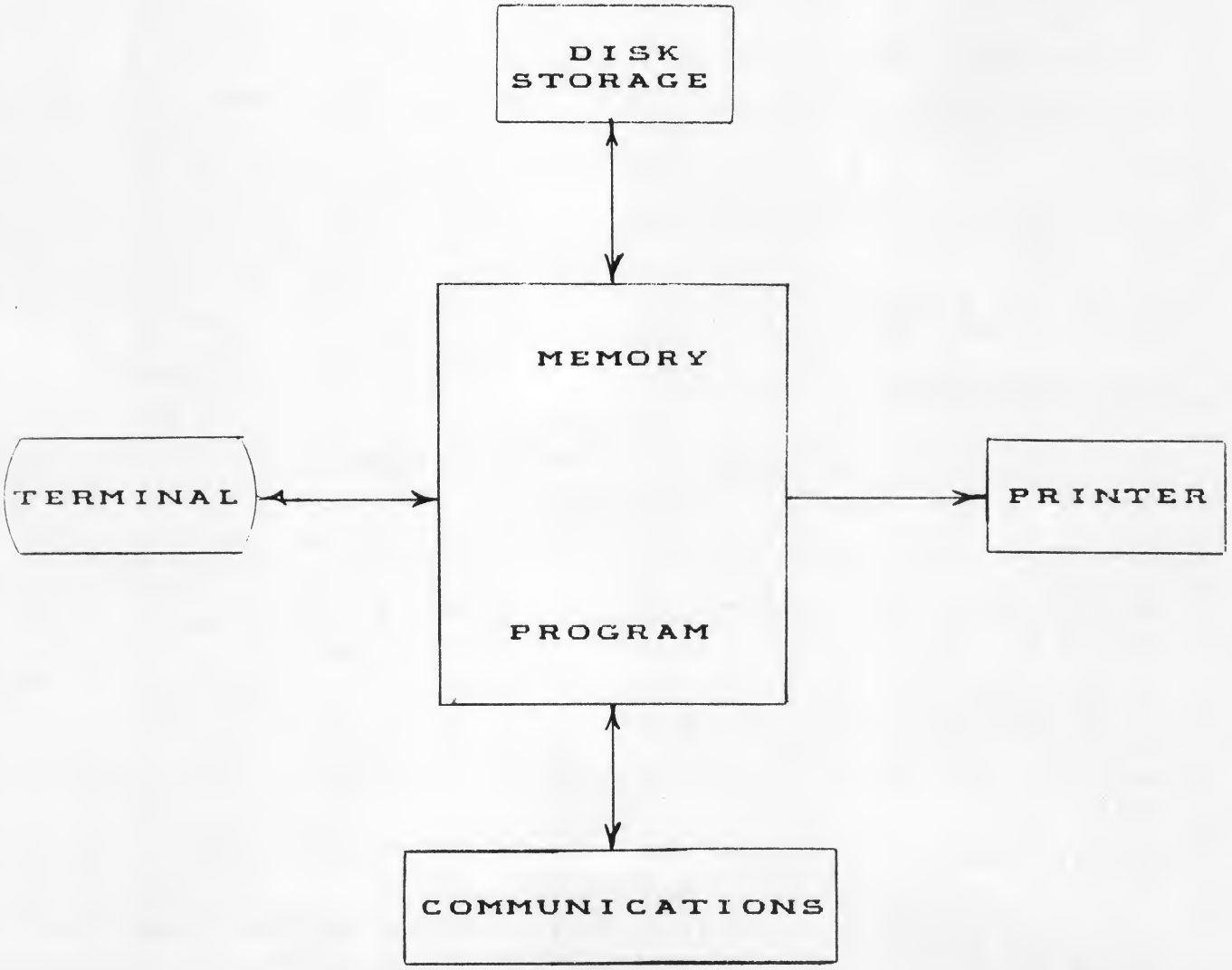
VDT- Video Display Terminal. The combination of a keyboard and CRT

CIU- Communications Interface Unit. The means of inter-connect for communication with another computing device

Disk Storage- For the external storage of programs and information. Uses either floppy disk drives or a hard disk

Program- The ethereal object that converts a computing machine into a tool. It is the reason you bought the computer in the first place.

A Personal Computer



Terminology

CPU- A processor which controls the operation and flow of information

Bus- A series of circuit paths for the transfer of information and control signals

Address Bus- Specifies the address of a memory location

Data Bus- The path over which information flows

Control Bus- For the transfer of control signals

Word- The amount of information sent over the data bus at one time

Byte- The memory space required to hold one character of information. There are one or more bytes in a word

Bit- Each byte is represented by 8 dots and dashes or bits.

RAM- Random Access Memory. The alterable information storage area

ROM- Read Only Memory. Non-erasable system memory.

Memory Size- The number of characters of information that can be stored in memory. Specified in K bytes of storage.

Clock- The Processor is synchronized by a high speed clock which controls all system timing. Usually 1-12 mhz.

Memory Mapped I/O - Sections of I/O processor are given memory addresses.

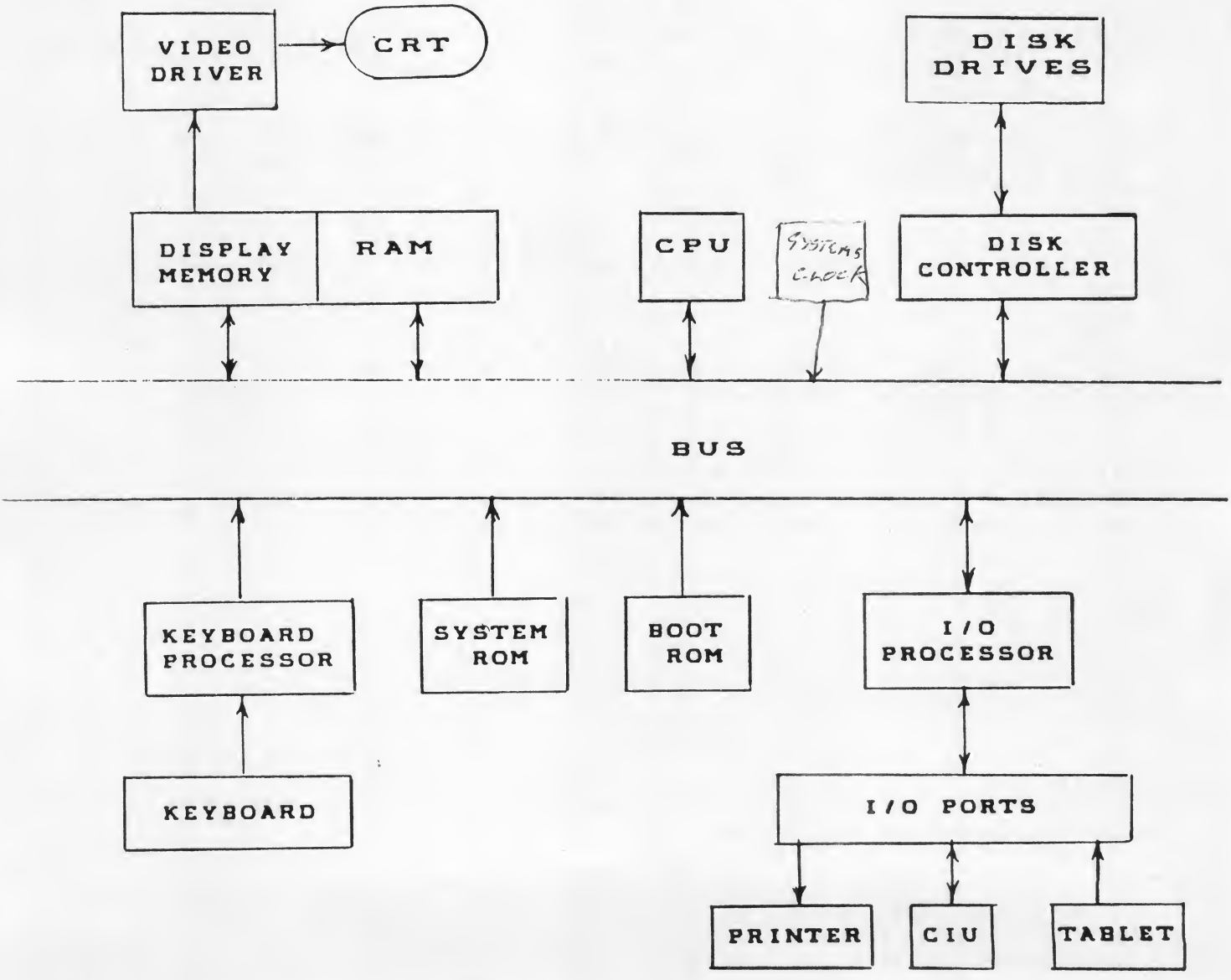
Mother Board- A back plane that allows individual circuit cards to be plugged in.

Parallel Port- Transfer of information to and from the world either one byte or one word at a time

Serial Port- Transfer of information to and from the world one bit at a time.

CoProcessor- Computes independently of the CPU freeing it for other tasks. For example a video driver.

Inside a P.C.


VIDEO DRIVER
CRT
DISK DRIVES
DISPLAY MEMORY
RAM
CPU
SYSTEMS CLOCK
DISK CONTROLLER
BUS
KEYBOARD PROCESSOR
SYSTEM ROM
BOOT ROM
I/O PROCESSOR
KEYBOARD
I/O PORTS
PRINTER
CIU
TABLET

More Terminology

Screen- A looking glass for viewing information in the machine. Typically these show 24 lines by 80 columns.

Disk Storage- For storing information not presently in use. Information can be written to or read from the disk storage devices.

Printer- The place where information is printed on paper

Communications- Devices attached to the computer to enable information transfer with another machine either by direct wiring or over the phone lines.

Personality Area- The memory area of the machine devoted to running your programs. The machine assumes the personality of any program loaded into this space.

Applications Program- Your Program.

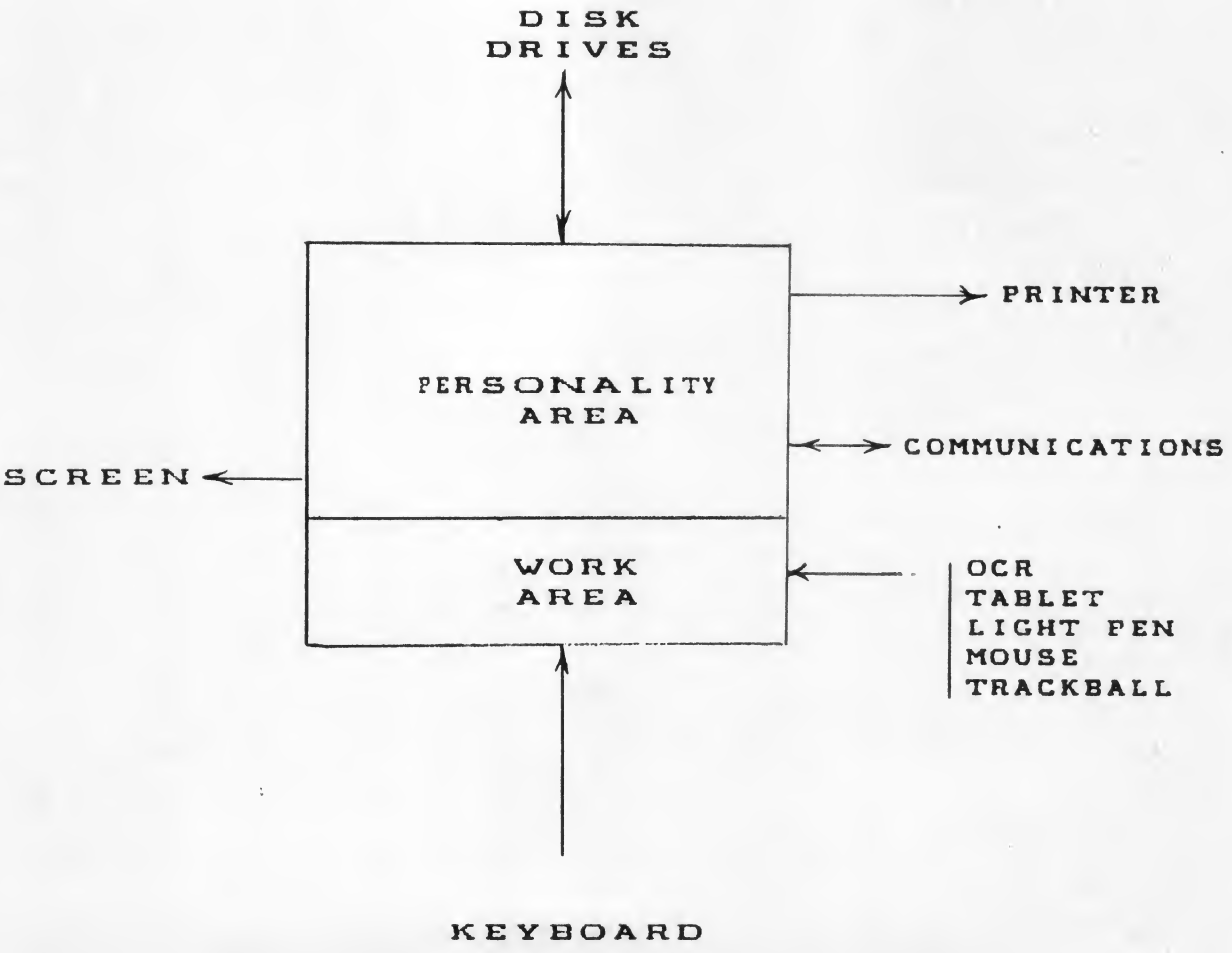
User Friendly- An easily usable system. How vendors always describe their product.

Operating System- A support program to enable the application program to more easily communicate with the various system hardware components.

Work Area- The portion of memory not used by the applications program and the operating system. It is available as a work area.

Peripherals- Any other devices you might consider hooking up to your computer to let you interact with it

How It Really Works



Personal Computer Statistics

Company Policy

Personal Computer policy in effect	8%
Data Processing Department approval	34%
File Transfers allowed	46%
Database Updating	7%
Data Processing purchase	49%

Personal Computer Applications

Financial	47%
Word Processing	22%
Scientific	19%
Marketing	12%

Installed by Brand

	Present			Projected	
	% D1	% D2	% Y	83	86Y
Apple	40	39	28	28	12
Radio Shack	23	18	17	12	14
IBM	18	13	18	24	19
HP	5	7	4	6	
Commodore	4	7	5	1	
Heath	3	2			
Xerox	2				
Osborne	2				
TI	2				
Dec		2		6	16
Nec					7
Others		16	28	24	32

D1- Datamation Mini-micro survey Nov82
D2- Datamation PC Survey November 1982
Y- Yankee Group Projections Fall 1982

Defining Requirements

The analysis of requirements for a computer system involves answering a series of WHAT questions. No knowledge of computers or computer systems is involved. The computer questions are the HOW questions that define hardware and software selection.

The WHAT Questions:

What are the processing requirements?

What do you want to do?

What are the Input Requirements?

What does the starting information look like?

What's its form and quantity?

What are the Output Requirements?

Storage: The type and volume of information

Reports: The views of the stored information

Printed Copy: Quality and volume of reports

Section 2

Software Overview

Software:

The reason you buy a computer. It consists of Computer Programs and Documentation.

Documentation:

The instruction manuals and system descriptions that explain the use of and operations of a program.

Application Programs:

Create a Machine personality for you to work with.

Systems Programs:

Operating System:

A program that provides an interface between the applications program and the physical machine. The behind the scenes technical production.

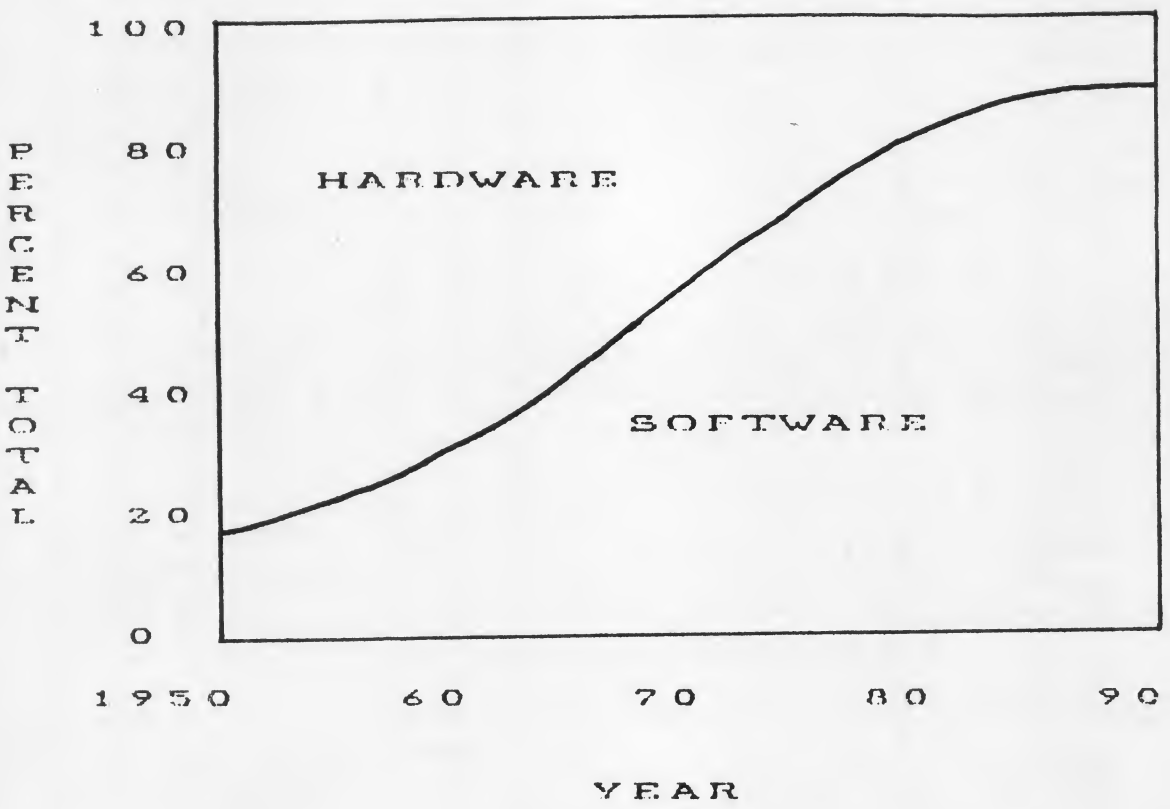
Utility Programs:

Housekeeping programs to handle system configuration, device assignments, file maintenance and programming support.

Programming Languages:

The systems used for the creation of applications and system software.

Hardware/Software Costs



Software Development

ANALYSIS

200 X

SPECIFICATIONS

90 X

DESIGN

30 X

CODE

X

UNIT TEST

INTEGRATION TEST

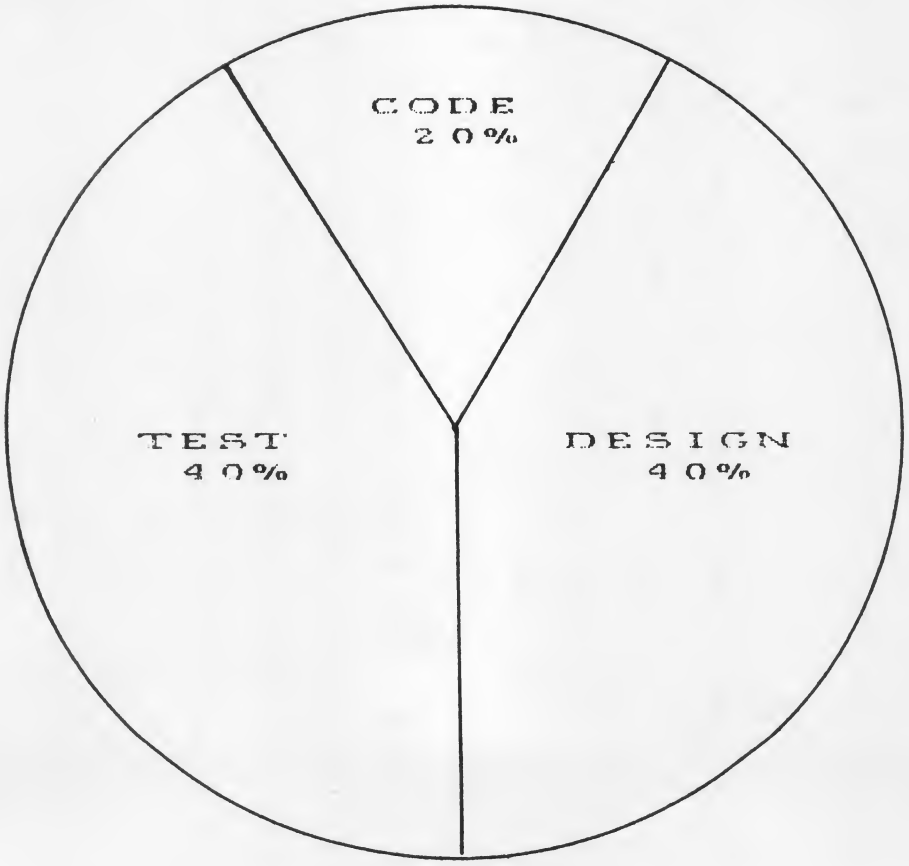
ACCEPTANCE TEST

OPERATIONS

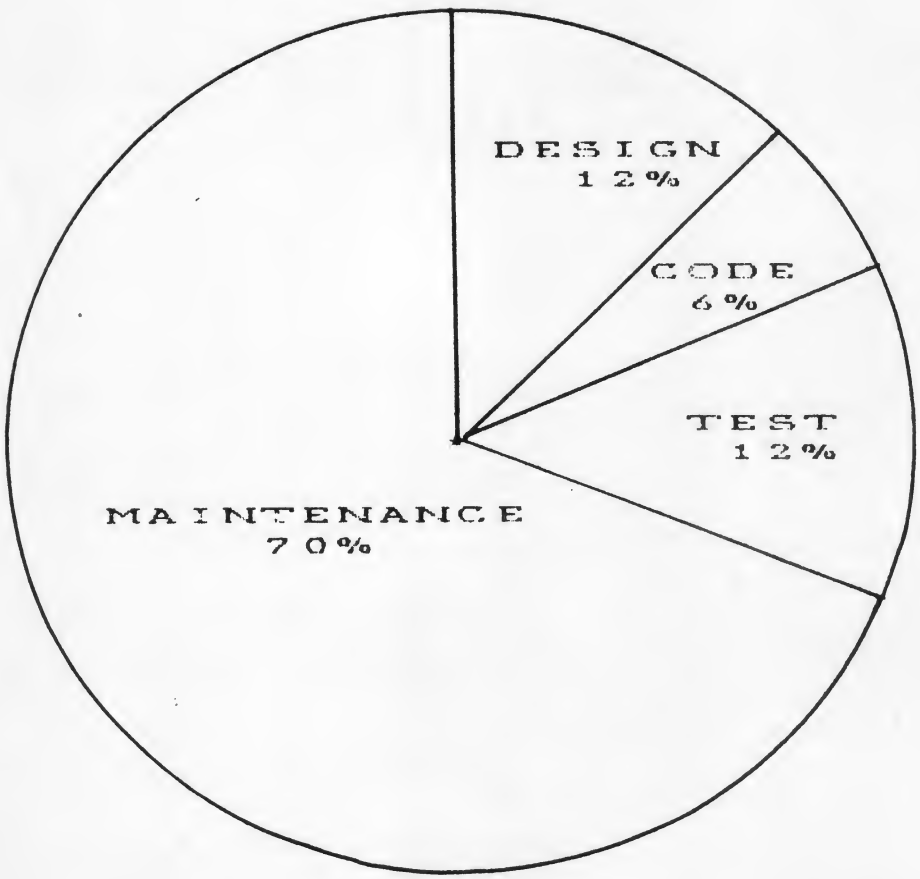
X = FIX TIME

LINES SHOW WHERE ERRORS SHOW UP

Software Development



Software Life Cycle



Develop Vs Purchase

Purchase Advantages

- Get Immediately
- Well Designed and Implemented
- See and Try Before You Buy
- More Flexible
- Lowest Possible Cost
- Better Documentation

Purchase Disadvantages

- Trouble Finding What You Want
- Big Mac Design
- May Have To Change Operations
- Evaluation Time Can Be Costly
- Extra Cost For Multiple Copies
- No Source Code
- Strict Contracts

Software License

- Purchase Right To Use The Software
- Single User, Single Machine
- Maximum Of Four Backup Copies
- Open The Wrapper Accept The License
- No Responsibility For Problems
- Discontinue License By Disk Return
- Updates Available at Extra Cost
- You Own The Backup Media
- Documentation Charges
- Rights Upon Business Termination
- Property Taxes

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Software Sources

- Computer Vendor
- Software Houses
- Computer Stores
- Mail Order
- User Groups
- Computer Bulletin Board Services
- Turnkey Systems
- Software Rental Agency
- Public Libraries

Evaluating Documentation

- Overview
- Instruction Section
- Technical Section
- Tutorial
- Illustrated With Screen Displays
- Written in English
- Table of Contents
- Index
- Detailed Examples
- Installation Instructions
- Troubleshooting Guide
- Newsletter or 800 Number
- Instruction Summary Card
- Instruction Aids
- Computer Aided Instruction
- Additional Books Available

Software Considerations

- Is Suited For Your Problem
- Default Values
- Menu Driven
- English Language Prompts
- On-Line Help (adjustable)
- Ease of Use
- Error Recovery
- Error Messages
- Protects You From Major Destructions
- Source Code
- Customization Notes
- Hardware Requirements
- Time on the Market
- Software Reviews
- Check with Users
- Company Reputation
- Interrelationship with Other Programs
- Is there a Trial Period
- Cost of Updates
- Vendor Newsletter
- Is there a Hot Line
- Single Machine License
- Multiple Use License Available
- Computer and Printer Installation
- Software Duplication
- Manual Duplication

Section 3

Applications Software

Software Quality Factors

Correctness

Reliability

Flexibility

Usability

Efficiency

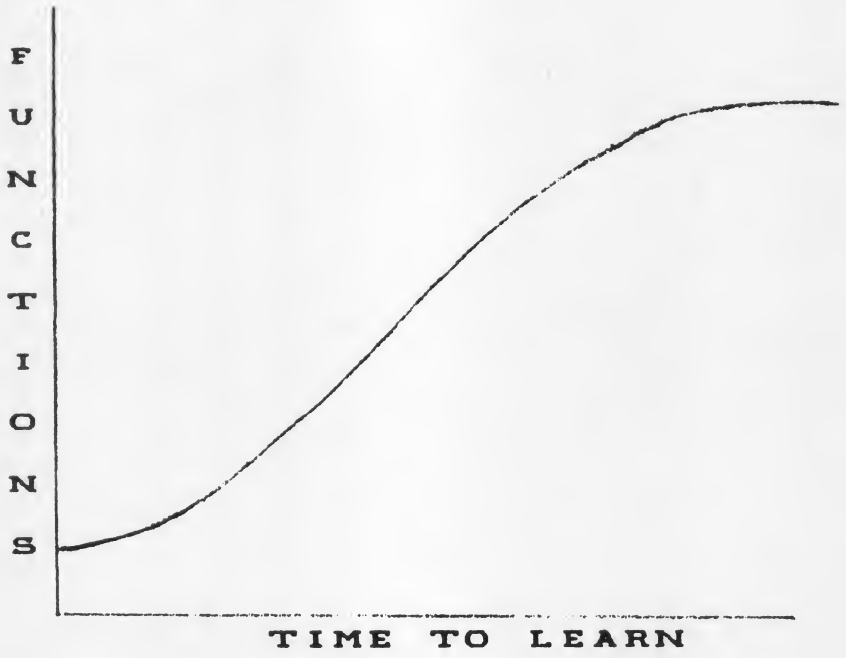
Integrity

Portability

Interoperability

work with other software packages

Software Flexibility



Word Processing Notes

COMPARISON OF CP/M WORD PROCESSORS

These ratings are copied from "Choosing a Word Processor" by Phillip Good (Available from Information Research, 10367 Paw Paw Lake Dr., Mattawan MI 49071) and from an article in Popular Computing published in February 1982 which was based on an earlier edition of the book cited above. The programs represented are:

P1 = Magic Wand (*1)
P2 = Memorite III
P3 = Mince
P4 = Palantier
P5 = Perfect Writer
P6 = Scripsit 1.0
P7 = Scripsit 2.0
P8 = Select
P9 = Spellbinder(*2)
P10 = Type Master
P11 = Vedit
P12 = Word Star

OVERALL	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12
years on market	3	1	1	1	1	1	3	1	3	1	2	3
price	500	398	125	289	289	389	100	595	495	400	130	445
for all CP/M based computers	yes	no	yes	yes	yes	no	no	yes	yes	yes	yes	yes
menu driven	no	no	no	yes	yes	yes	no	yes	no	no	no	yes
can display multiple files	no	no	yes	no	yes	no	no	no	yes	no	no	no
displays text on screen as it will appear in print	no	yes	no	yes	no	yes	no	yes	yes	no	no	yes
handles files larger than memory	yes	no	yes	yes	no	yes	no	no	yes	yes	yes	yes
can edit programs as well as text	yes	no	yes	yes	yes	no	yes	no	yes	yes	yes	yes
customized control characters	yes	no	yes	hard	yes	no	no	no	yes	yes	yes	no

DOCUMENTATION	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12
getting started	easy	easy	slow	hard	good	slow	slow	best	easy	easy	hard	hard
tutorials	excl	poor	vgood	yes	vgood	best	good	vgood	good	some	poor	good
examples	many	many	none	some	some	many	yes	none	few	few	none	some
help menus	some	many	none	yes	yes	yes	no	yes	yes	no	no	yes
reference material	good	good	good	poor	good	fair	no	excel	good	some	fair	excel
separate reference card	yes	no	no	long	yes	yes	yes	yes	no	no	no	yes

FILE CONTROL	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12
continuous back-up	no	no	no	no	yes	page	no	no	no	yes	no	no
save file and continue editing	yes	no	yes	yes	yes	yes	yes	yes	yes	no	yes	yes
automatic back-up on file save	yes	yes	no	yes	no	no	no	yes	yes	yes	no	yes
file replace safeguards	yes	yes	yes	yes	no	no	no	no	yes	yes	yes	yes
insert second file in one command	no	yes	yes	add	yes	yes	yes	yes	yes	yes	no	yes/no
insert a portion of a second file	yes	yes	yes	no	yes	no	no	no	yes	no	no	yes/no
display second file	yes	yes	yes	yes	yes	no	no	no	yes	no	no	no
display file directory	yes	yes	yes	yes	yes	yes	no	yes	yes	iffy	no	yes
kill file (and create space)	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	no	yes
can prepare file for transmission	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes

CURSOR CONTROL	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12
by word	yes	no	yes	yes	yes	no	no	no	yes	yes	no	yes
by line	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	yes	yes
by sentence	no	no	yes	yes	yes	yes	no	no	yes	no	no	yes
by screen	yes	yes	yes	yes	yes	page	no	yes	yes	yes	yes	yes
to beginning or end of workspace	yes	no	yes	yes	yes	yes	yes	no	yes	yes	yes	yes
to beginning or end of document	no	no	yes	yes	yes	yes	yes	no	yes	no	no	yes
horizontal scroll	no	no	no	yes	no	yes	yes	no	yes	yes	no	yes

DELETE	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12
by character	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	yes
by word	no	yes	yes	yes	yes	yes	yes	no	yes	no	no	yes
by line	yes	yes	yes	yes	yes	no	no	no	yes	yes	yes	yes
by sentence	no	yes	yes	yes	yes	yes	yes	no	yes	no	no	no
by screen	no	no	yes	yes	no	no	no	no	no	no	no	no
by block	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no	yes
continuous	no	no	no	yes	no	no	no	yes	no	no	no	no
block delete safeguards	yes	yes		yes	yes			yes	yes	no	no	yes

INSERT	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12
phrases inserted with single key	none	none	none	36	none	yes	no	none	43	none	none	none
typeover (fast)	yes	yes	no	yes	yes	yes	yes	yes	yes	no	no	yes
insert mode (fast for sev. lines)	yes	no	no	no	no	yes	yes	no	yes	no	yes	yes
push ahead (fast for few chars)	yes	yes	yes	yes	yes	no	no	no	no	yes	yes	yes
split and glue a line at a time	no	no	no	no	no	yes	yes	no	yes	yes	no	no
intermediate buffer	no	no	no	yes	no	no	no	yes	yes	no	no	no
block whole sections	yes	yes	no	slow	no	yes	yes	yes	yes	hard	yes	yes
move columns	no	no	no	no	no	no	no	no	yes	yes	no	yes
delete and restore	no	no	yes	no	yes	no	no	no	yes	no	no	no

SEARCH	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12
find phrase anywhere in document	no	no	no	slow	no	yes	yes	no	yes	yes	yes	yes
find with user option to replace	no	yes	no	yes	yes	yes	no	yes	yes	no	no	yes
find and replace n times	yes	yes	no	yes	no	yes	yes	yes	yes	no	no	yes
find and replace all in document	no	no	no	slow	no	yes	no	no	yes	no	no	yes
find and replace all in memory	yes	yes	no	yes	yes	yes	yes	yes	yes	no	no	no
use wildcards	no	yes	no	yes	no	no	yes	no	yes	no	no	yes
ignore u/l case in matching	yes	yes	yes	yes	yes	no	no	no	yes	yes	no	yes

SCREEN FORMAT	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12
format entire text	no	yes	no	yes	no	yes	yes	yes	yes	yes	no	yes
format different parts differently	no	no	no	yes	no	yes	yes	no	yes	yes	no	yes
set line length	yes	yes	no	yes	no	yes	yes	yes	yes	yes	no	yes
set tabs with cursor	no	yes	no	yes	no	yes	yes	yes	yes	yes	no	yes
set tabs by command	yes	no	yes	no	yes	yes	yes	yes	yes	no	yes	yes

PRINTER FORMATTER

OVERALL	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12
display on screen as it will print	yes	yes	yes	yes	yes	yes	no	yes	yes	yes		yes
mail-merge or file-merge	yes	yes	no	xtra$	no	yes	no	no	yes	yes		Xtra $
almost all printers supported	yes	yes	most	yes	most	many	most	many	yes	some	none	yes
conditional formats	yes	no	yes	xtra$	yes	no	no	no	hard	yes		no
footnotes	no	5/pg	no	no	yes	no	no	no	no	yes		Xtra $

LAYOUT	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12
from menu	yes	yes	no	yes	no	yes	no	yes	yes	no		yes
menu may be skipped	yes	yes	no	yes	no	yes	no	no	yes	yes		no
under user control	yes	yes	yes	yes	yes	no	no	no	yes	yes		yes
characters per inch	yes	yes	yes	yes	yes	yes	no	yes	yes	hard		yes
lines per inch	part	yes	yes	yes	yes	yes	yes	no	yes	hard		yes
width limitation	none	none	none	none	none	156	132	132	none	none		none

PAGE CONTROL	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12
one-line heading	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes		yes
multi-line heading	yes	yes	yes	yes	yes	yes	yes	yes	yes	no		no
heading and footing	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes		yes
page numbering	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes		yes
odd/even page distinction	no	yes	yes	yes	yes	no	yes	no	yes	no		yes
conditional new page	yes	no	yes	yes	yes	no	no	no	hard	yes		yes

TEXT CONTROL	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12
justify	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes		yes
center	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes		yes
phantom hyphen	yes	yes	no	yes	no	no	yes	no	yes	yes		no
multiple columns	yes	yes	no	yes	no	yes	no	no	yes	yes		yes
reverse line feed	yes	yes	no	yes	no	yes	no	no	yes	no		no

PRINTER CONTROL	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12
underline	yes	yes	yes	yes	yes	yes	no	yes	yes	yes		yes
boldface	yes	yes	yes	yes	yes	yes	no	yes	yes	yes		yes
vary boldface intensity	yes	no	yes	yes	yes	no	no	no	yes	no		yes
super- and subscript	yes	yes	yes	yes	yes	yes	no	yes	yes	yes		yes
change ribbon colors	no	no	no	yes	no	no	no	no	yes	no		yes
kerning	yes	yes	yes	no	yes	no	no	no	no	no		no
change control characters	yes	no	yes	yes	yes	yes	no	no	yes	yes		no
proportional spacing	part	yes	no	yes	hard	no	no	yes	yes	no		no

OUTPUT CONTROL	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12
interrupt, resume	yes	yes	yes	yes	yes	yes	no	yes	yes	yes		yes
alter format	yes	no	no	yes	no	no	no	no	yes	yes		yes
pause for text entry	yes	yes	yes	yes	yes	no	no	no	hard	yes		yes
pause for variable entry	yes	yes	yes	xtra$	yes	no	no	no	hard	yes		yes
start/stop as designated	yes	yes	no	yes	no	yes	yes	yes	yes	yes		yes
print multiple documents	no	yes	yes	yes	yes	no	no	no	yes	yes		no
print multiple copies	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes		yes

TOTAL POSITIVE RATINGS	68	63	56	78	56	62	41	45	86	61	15	71

*1 Now called Peach Text
*2 Does not include Office Management features of Spellbinder

Spelling Checkers

Company	Product	Dictionary	Type	Price
Apparat Inc	Chextest	20,000	L	$ 59.95
Aspen Software	Proofreader	86,000	L	$129.00
Cornucopia Software	Microproof	50,000	R	$229.00
	Electric Webster	50,000	L	$169.00
Intelligent Computer	MS Speller	69,000	R	$175.00
Key Bits	WordSearch	8,000	L	$125.00
Lifeboat Assoc.	Microspell	26,000	R,L	$249.00
MicroPro	SpellStar	20,000	L	$195.00
Oasis Systems	The WORD Plus	45,000	L	$150.00
Peachtree Software	Spelling Proof.	80,000	R	$300.00
Perfect Software	Perfect Speller	50,000	R	$189.00
Proximity	Easy-Speller	88,710	L	$175.00
Quark	Lexicheck	30,400	R,L	$195.00
Radio Shack	Scripsit Dict.	100,000	L	$199.00
Sensible Software	Sensible Speller	84,000	L	$125.00
Software Toolworks	SPELL	50,000	R	$ 49.50
Sorcim Corp.	Spellguard	20,000	L	$295.00
Stellarsoft Corp	Disc-tionary	45,000	R,L	$ 79.00
Universal Software	Pro-Spell-Plus	30,000	R	$200.00

Spread Sheet Notes

SuperCalc[2]™

Comparison of Spreadsheet Packages

	SuperCalc[2]™	VisiCalc™ Advanced Version	Multiplan™	CalcStar™
CP/M-86* Operating System	yes	no	yes	yes
CP/M-80* Operating System	yes	no	yes	yes
IBM DOS Operating System	yes	yes	yes	yes
Max Column/Rows	63/254	63/254	63/255	127/255
Independently Variable Column Width	yes	yes	yes	yes
Sorting	yes	(with VisiFile only)	yes	(with SuperSort only)
Consolidation	yes	yes	yes	no
Enhanced Display/Formatting ($,"'")	yes	yes	yes	(with WordStar only)
Number of Cells (64K)	1500/3000	varies by machine	1000/2000	varies by machine
Protected Areas	yes	yes	yes	*
Digits Precision	16	11	14	14
Zero Width Columns	yes	no	no	no
Editing Cell	yes	yes	yes	no
Labels Wider Than a Column	yes	no	yes	no
Disk Directory Preview	yes	yes	yes	no
Auto cursor advance	by choice	no	by choice	*
Display, Print All Formulas	yes	yes	yes	print only
Scientific formatted numbers	yes	yes	yes	overflow only
Split Screen Viewing	yes	yes	yes	no
Maximum Column Width	127	125	32	63
Tab Mode	yes	yes	yes	no
Load Partial Model	yes	no	(values only)	yes
Output to Word Processor	yes	no	yes	yes
Histogram Graphics	yes	yes	no	no
Automatic Recalculation	choice	choice	choice	no
Conditional Logic	yes	yes	yes	yes
Command Input From File	yes	yes	no	no
Rapid Display Scrolling	yes	yes	yes	soon

*Provided by Automatic Form Mode

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Multiplan is a trademark of MicroSoft Corp
CalcStar is a trademark of MicroPro International Corp
CP/M and CP/M-86 are trademarks of Digital Research

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SORCIM
2310 Lundy Ave., San Jose CA 95131

Microsoft™ Multiplan™ vs the Other Electronic Worksheets

A Comparative Analysis

User Convenience Features

A Comparative Analysis

If you're relatively inexperienced with computers, you should consider the availability of user convenience features with different electronic worksheets. The prompt feature, which gives you a choice of answers or commands, is especially useful if your computer experience is minimal.

	Multiplan	VisiCalc*.	SuperCalc™
Ability to build formulas by highlighting cells ■	YES	YES	YES
Command prompting ■	YES	YES	YES
Use of full English words for commands ■	YES	NO	YES
Use of English formulas ■	YES	NO	NO
Online reference guide ■	YES	NO	YES
Display options: ■			
Number of windows •	8	2	2
Full-screen display of formulas •	YES	NO	YES

***Note**: *These comparisons were made on the IBM Personal Computer, using VisiCalc version VC 156YO IBM and SuperCalc version 1.10, documentation 1.0*

Mathematical and Operations Capabilities

How complex are your numerical modeling needs?

If you want to perform fairly simple forecasting and modeling functions, such as the development of household budgets or pricing worksheets, then you can probably get by with an electronic worksheet with fairly limited mathematical capabilities. But if you are going to be doing complex projects such as the consolidation of budgets, forecasts, and financial plans, you should look for the electronic worksheet with more extensive mathematical functions and operations. You definitely will need the capability to update summaries and consolidate reports by automatically linking worksheets.

	Multiplan	VisiCalc*	SuperCalc
Automatic linking of worksheets ■	YES	NO	NO
Cell referencing methods (naming, relative reference, absolute reference) ■	3	1	1
Arithmetic functions (SUM, AVERAGE, SQ. RT., etc.) ■	16	12	12
Trigonometric functions (SINE, COSINE, etc.) ■	4	6	6
Conditional functions (IF-THEN, AND, OR, etc.) ■	8	8	4
Table functions (LOOKUP, Index) ■	2	2	1
Financial functions (NET PRESENT VALUE) ■	1	1	1
Statistical functions (STANDARD DEVIATION) ■	1	0	0
Error functions (NA, ERROR) ■	1	2	2
String functions (string length, mid-string, etc.) ■	5	0	0
Other functions (row, column) ■	2	0	0

Format and Report Capabilities

Will you prepare typed reports?

You should check out how the different worksheets format and print reports and how much user input is needed to produce a hard copy that is properly formatted, with commas and decimal points correctly aligned. Most electronic worksheets do not allow you to place commas in numbers at all. When you're preparing large worksheets you'll find automatic page breaks a useful feature. Multiplan's "text calculation" capability allows you to set up formulas that print out relevant text in presentation form.

	Multiplan	VisiCalc*	SuperCalc
Text calculation ■	YES	NO	NO
Alphabetical/numerical sorting ■	YES	NO	NO
Formatting options: ■			
Variable column width •			
All columns—	YES	YES	YES
Individual columns—	YES	NO	YES
Number of alignment options •	3	2	2
Number of format options •	9	7	7
Can user fix decimal point? •	YES	NO	NO
Commas permitted in numbers •	YES	NO	
Printed report options: ■			
Variable margins •	YES	NO	NO
Automatic pagination (breaking into pages) •	YES	NO	NO
Print formulas •	YES	YES	YES

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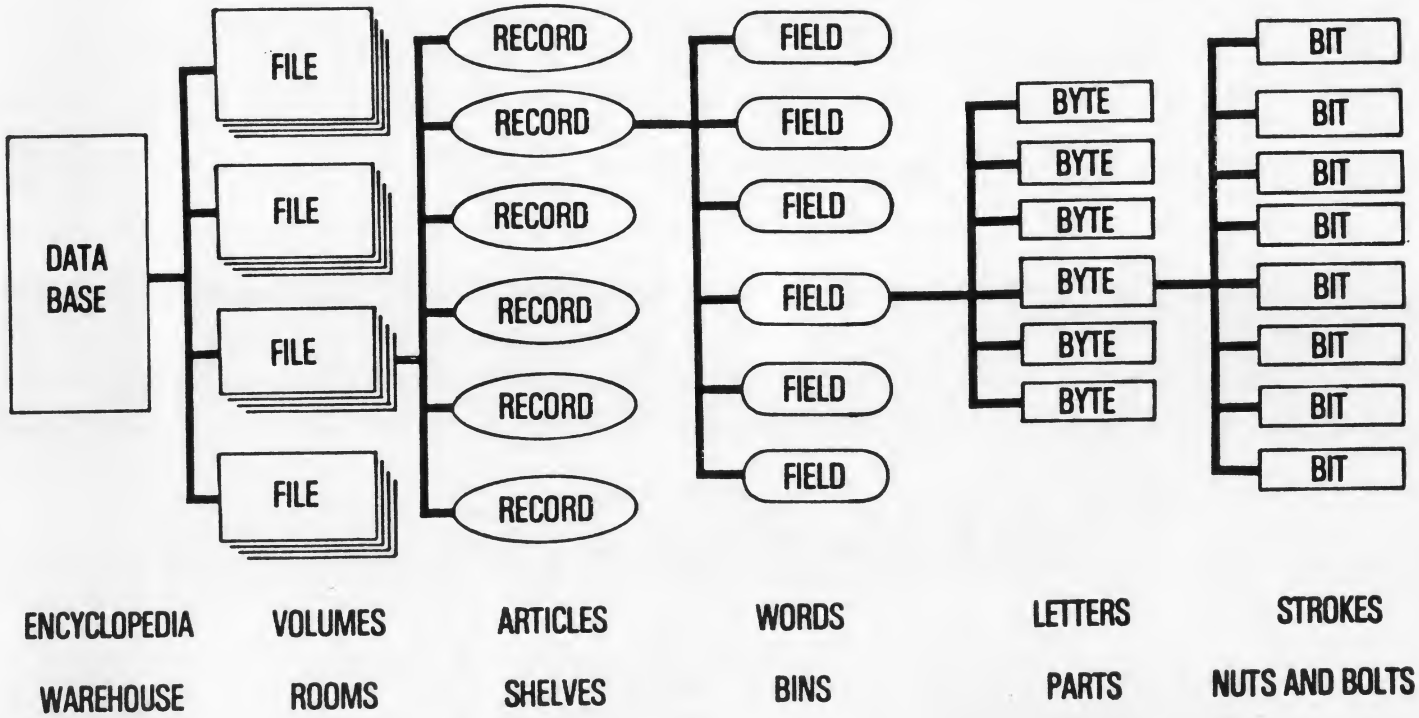
Calculation Spreadsheets

Company	Product	Price
Chang Labs	MicroPlan	$ 495.
Comshare Target	PlannerCalc	$ 50.
Ferox Microsystems	Micro/DSS Finance	$1500.
Hayden Publishing	FINPLAN	$ 75.
Intelligent Systems	Color Calc	$ 200.
Lifeboat Associates	PLAN80	$ 495.
	FPL	$ 745.
	T-MAKER II	$ 275.
MicroPro	CalcStar	$ 495.
Microsoft	Multiplan	$ 275.
Osborne	Microfinesse	$ 495.
Peachtree	PeachCalc	$ 295.
Software Products	LOGICALC	$ 290.
Sorcim	SuperCalc	$ 295.
Structured Systems	Magic Worksheet	$ 250.
SuperSoft	ScratchPad	$ 295.
Vector Graphic	ExecuPlan	$ 150.
VisiCorp	Desktop/PLAN	$ 350.
	VisiCalc	$ 250.
	VisiCalc Advanced	$ 400.
	Visicalc Business	$ 100.

DATA STRUCTURES



DBMS Comparisons

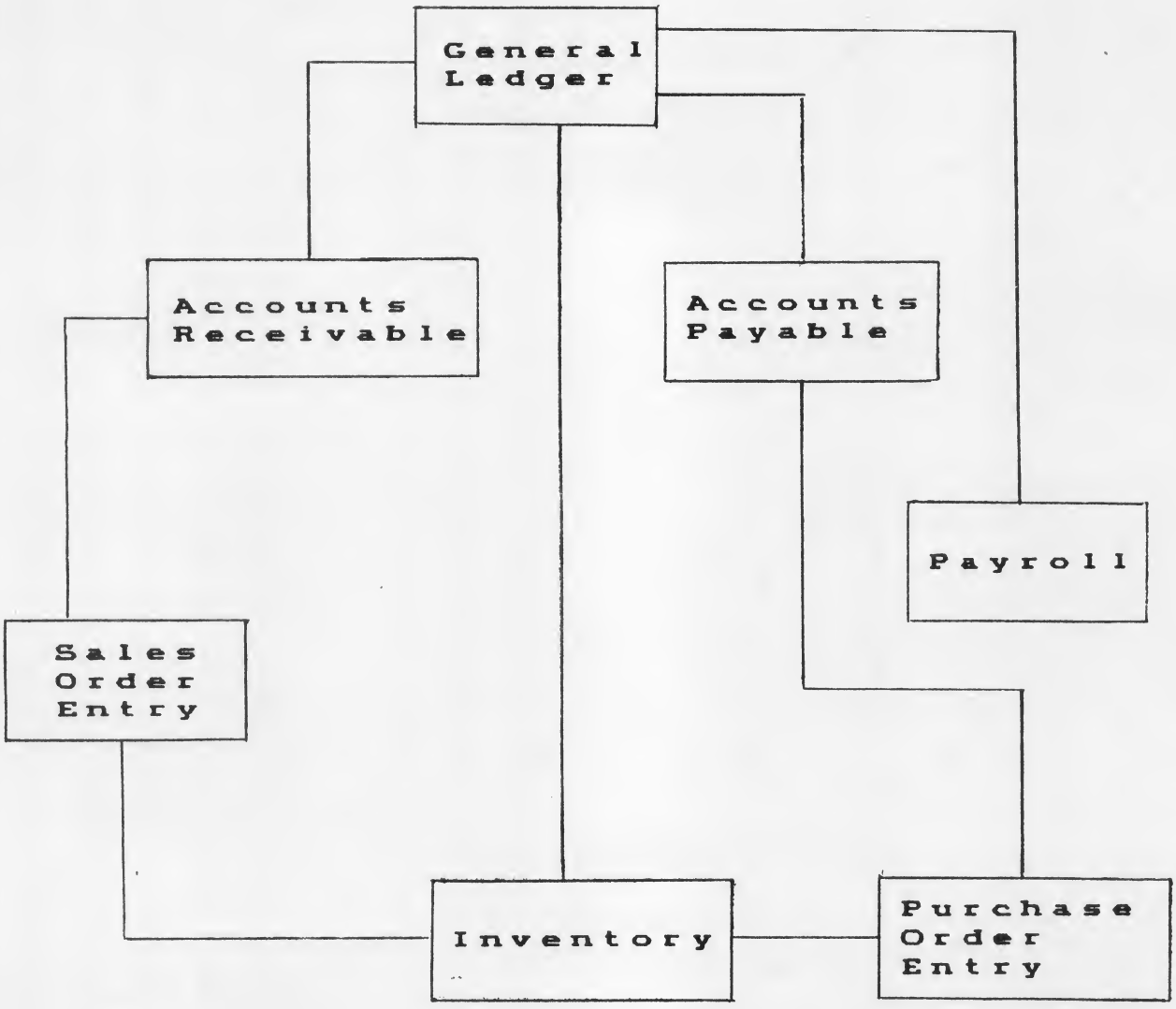
	Analyst	Condor	d-Base	FMS-80	Selector
Price	$350	$995	$700	$990	$495
Menu Driven	Yes	No	No	Yes	No
Command Lang.	No	Yes	Yes	Yes	No
Documentation	Good	Good	VG	Fair	Good
Easy to Start	Yes	Mod.	Yes	No	No
Password	No	Yes	No	No	No
Record Length	225	1024	1000	20K	25K
# Fields	50	127	32	255	19
Field Length	255	127	254	255	255
Report Functions	Fair	Exc.	Exc.	Poor	VG
Sort 1000 Recds	2.75	3.5	14.5	12	3
Index 1000 Recds		3.5	3	4	4
Key Search	3sec	3sec	3sec	3sec	3sec
Find 50 Records	6.5	.3	3	4	2.5
Delete 50 Pack	20	7.5	81	11.6	1.3
Merge 50 Records	2.8	3.75	3.5	15	1

Benchmark - Z80 64KRAM 4 mHz clock
Records - 15 fields, 128 characters (135-155K)
Ref. Byte - May 1983

Business Software

- General Ledger
- Accounts Payable
- Accounts Receivable
- Payroll
- Inventory
- Job Costing

Business Systems



Since 1977, Condor Computer Corporation has been the leader in supplying applications development and operating software utilizing a relational database file organization.

Acceptance of this system (Series 20) by many users has proven there is a demand for easy-to-use software that provides efficient operation and cost effective information processing. Condor's products are easy to use and, in addition, its reliability has been unparalleled in the software industry.

Condor Series 20 has been designed to reduce programming and implementation cost and provide exceptional quality. It is "user friendly".

WHAT IS CONDOR'S DATABASE SYSTEM

Unlike other database systems, Condor Series 20 is a *complete development and operations system*. When you select Condor's Series 20, you need not purchase additional software other than an operating system.

WHY YOU NEED A DATABASE SYSTEM

More than 50% of the people looking for micro computer software cannot find custom packages to fit their specific requirements.

If a custom package has been found it generally does not meet all the requirements. Changing a custom package to fit your requirements is very time consuming and difficult unless the package has been developed with a good database system.

Those people who have found a specialized package to fit one of their requirements soon find they want to do more with their computer.

The person using a micro-computer system does not have the time to learn a programming language like Cobol, Basic, etc. A database system is easier to use hence reducing the learning time and eliminating the programming time.

WHY CONDOR'S SERIES 20 SYSTEM

Series 20 is easy to learn and use.

Applications can evolve. You can start with a simple database. If you've forgotten a field you can reorganize the data in a few minutes. Later, as other databases evolve, you can join data from several databases to obtain the information you need.

Condor offers cost effective entry into the Series 20 product line. Your initial investment can be as low as $295.00 for Condor 20-1. Condor 20-1 is fully upward compatible to Condor 3 which offers full computer system capability.

Competitive comparisons by independent evaluators have rated Series 20 more "user friendly", more complete, and more flexible than any other database system in the micro computer market.

EXCEPTIONAL FEATURES

- Develop data bases without professional computer programmer assistance.
- Relationally structured — easier to understand than network or hierarchical system.
- Data entry and updating is easy with your self designed screen formats.
- Series 20 is a self contained data language — No host language compiler is required.
- Transaction processing features for efficient transaction posting to a master database file with audit trail.
- JOIN and PROJECT relational and set operations are provided for combining and processing multiple databases.
- Complete menu selection facilities you tailor according to your operating requirements.
- Command procedures include conditional processing, user defined messages and restart capability.
- SORT command is fast and efficient using up to 32 keys.
- FORMAT command provides powerful screen editing capabilities for both data base development and reporting.

OUTSTANDING CAPABILITIES

DATABASE CREATION AND MAINTENANCE

- Easy database creation and restructuring
- Five data types permitted:
  Alphabetic, Alphanumeric, Date, Dollar, and Numeric
- Screen form design
- Editing limits and defaults for operator data entry

INFORMATION INPUT AND UPDATE

- Compatible with most popular CRT terminals
- Data input and update using screen format
- Duplication of data during entry
- Update data from one database to another adding, subtracting, or replacing data values
- Automatic posting audit trail
- Compute results
- Mass data changes

INFORMATION REPORT WRITING AND ANALYSIS

- Compare two databases for matching or not matching conditions
- Relate information from multiple databases
- Select data meeting logical conditions
- Sort up to 32 fields
- Detail or summary reports with level breaks
- TITLE command for report headings
- Re-format output data
- Calculate statistics

OPERATOR AIDS

- Help screens provide menu selection of options
- Conditional processing of commands
- User-defined messages
- Restart capability
- Parameter values may be entered from the terminal

SERIES 20 COMMANDS

DATABASE CREATION AND MAINTENANCE

DEFINE	Create a new database, redefine a database, describe a database
DESTROY	Eliminate a database or file
FORMAT	Create or revise a form. Create or revise a HELP screen
REORG	Reorganize the structure of a database, adding or deleting data items

INFORMATION INPUT AND UPDATE

APPEND	Attach records of one database to another
CHANGE	Change data item values in a database
COMBINE	Attach records of two databases, creating a RESULT database
DELETE	Delete records of a database meeting specified conditions
EMPTY	Eliminate all data in a database
ENTER	Insert new data into a database
POST	Update data item values in one database with those from another
UPDATE	Change data item values in a database meeting specified conditions

INFORMATION PROCESSING AND REPORT WRITING

COMPARE	Compare data item values in two databases for (not) matching conditions and create a RESULT database.
COMPUTE	Compute data item values in a database
DISPLAY	View selected records of a database
INDEX	Create quick access path by specified data item names
JOIN	Attach data items of two databases by matching data item values
LIST	Produce a video display of records of a database in sequential order
PRINT	Print records of a database in sequential order
PROJECT	Create a RESULT database from selected data items of a database
REPORT	Create, modify, or print a report
SELECT	Select database records meeting specified conditions, creating a RESULT database
SORT	Sort database records by data item values
STAX	View or print statistics of data items values
TABULATE	Summarize specified data item values. Print or save the result
TITLE	Print report headings

OPERATION AIDS

HELP	Assist operator in selecting procedures
RESTART	Continue processing of an interrupted command procedure
RUN	Process and execute a command procedure with options for command modification

INTERFACES

READ	Transfer records from an ASCII file to an existing database
WRITE	Transfer records from a database to an ASCII sequential file

UTILITIES

COPY	Copy a database or file
DATE	View or enter date
DIC	View entries in the data dictionary
DIR	View the list of files in the disk directory
LOGDISK	Log a new disk in the computer
RENAME	Change the name of a database or file
SAVE	Save a RESULT database
SET	Set operating parameters
SYSTEM	Exit from back to operating system
TERM	Defines system video terminal

SPECIFICATIONS

Number of Records	32,767
Record Size	2 to 1024 bytes
Fields per record	1 to 127
Alphanumeric Data	1 to 127 bytes
Numeric Data	1 to 10 digits
CRT Screen	24 lines 80 columns

SYSTEM REQUIREMENTS

Processors: Z80,8080/8085, 8086/8088;64 K memory, IBM PC needs 80 K memory

Operating Systems: CP/M, MP/M, CDOS, TURBODOS, MSDOS, CP/M-86, PCDOS

CRT Terminal: Cursor addressing, screen erase, line wrap

Printer: Line or character printer with form feed

The most powerful, easiest to use micro DBMS

dBASE II is what database management is all about.

It's an information-handler, not a file handler.

It's relational, not hierarchal, so you don't have to get involved with sets, lists, pointers and all the other complexities still around from the 1960's.

It's interactive so that data entry is easy.

It can be programmed so that even untrained personnel can accurately run even your most complicated applications.

It gives you full X-Y control so that input and output are done the way you want them done, even on your existing forms.

It has a full English-like language of its own so it's easy to use, with structures that make it easier to use right.

Changing, extending, modifying of databases take a few simple commands.

And the documentation is so thorough that it's almost a mini-course in database management (see the partial table of contents).

What can you do with it?

With dBASE II you can extend the power of your microcomputer to jobs that were previously reserved for the larger mainframes. Here's a partial list of applications that dBASE II has been used for:

- General Ledger
- Journal of Accounts
- Accounts Receivable
- Accounts Payable
- Sales Tax Records
- Payroll
- Check Management and Writing
- Time Billing
- Inventory Control
- Job Costing
- Tax Computation
- Document Cross Referencing
- Legal Office Accounting
- Scheduling
- Mailing Labels
- Calendar Events

If your application calls for managing data, dBASE II may be the answer.

It's easy to use.

You can create a database and start entering data into it in less than a minute.

Type CREATE, then respond to the dBASE II prompts to name the file and define the fields in your records as shown in the first photo.

Once the record is defined, you can start entering data immediately, or add information later by typing APPEND. In both cases, dBASE presents you with an entire record structure for which you simply fill in some or all of the blanks.

```
. CREATE
ENTER FILENAME  DATABASE
ENTER RECORD STRUCTURE AS FOLLOWS
 FIELD   NAME,TYPE,WIDTH,DECIMAL PLACES
 001     Check Date,C,7
 002     Check Nmbr,C,7
 003     Client,C,3
 004     Job Nmbr,N,3
 005     Name,C,20
 006     Descrip,C,15
 007     Amount,N,9,2
 008     Bill Date,C,7
 009     Bill Nmbr,C,7
 010     Hours,N,6,2
 011     Emp Nmbr,N,3
 012
INPUT DATA NOW? N
```

Creating a new database is simply a matter of naming it, then deciding how big to make the fields and what kind of data you're going to keep in them.

```
*********  POSTBILLS COMMAND FILE *********
* Enters bills in the POSTFILE as they come in.
* A temporary file called BILLS:IN is used so that
* only the required structure is displayed on the
* screen for entry.  After entry, records are moved
* to the POSTFILE and Bills:In is deleted.  The
* CostUpdate command file is later used to move
* these to the COSTBASE after they are verified.
*       NOTE that if the POSTFILE is indexed, entries
* will automatically be added to the index since they
* are added to the file with the APPEND command.
*****************************************************

ERASE
USE PostFile
COPY TO Bills:In STRUCTURE FIELDS Client, Job:Nmbr,;
          Name, Descrip, Bill:Date, Bill:Nmbr, Amount
USE Bills:In

STORE 'Y' TO Continue
DO WHILE !(Continue) = 'Y'
   APPEND
   ? 'More SUPPLIER BILLS to enter (Y or N)?'
   WAIT TO Continue
ENDDO

USE PostFile
APPEND FROM Bills:In

ERASE
DELETE FILE Bills:In
RETURN
```

Entire databases can be moved, copied or otherwise manipulated without having to re-enter your data.

Turning the data into information.

You can work with your database interactively (conversationally) or with programs that you set up using the English-like dBASE II commands.

Most dBASE II commands are verbs, supplemented with programming structures that make it easier to assemble clear programs even if you're not a programmer.

If you want to repeat any of the things you did, put the commands together in a command file, then anyone in your office can perform the entire set of operations with a single command (DO Payroll, DO Posting, DO Whatever).

Either way, you're in full control of all database operations. Display some or all of the data for any conditions that you want to apply. Manipulate the data all the way from entire databases down to single characters in a data field. Change your data or your entire database structure with a few commands, without re-entering the entire database. Do automatic calculations on fields, records, and entire databases with a few keystrokes.

For even faster data handling, INDEX your databases. With this feature, you can find any record in under two seconds for a medium-to-large database, even using floppies. No other system even comes close.

And when it comes to output, dBASE II is heads and sub-totals above anything else on the market. The REPORT command culls through your databases, and selects whatever information you want, then totals, sub-totals and presents it exactly the way you want it.

When you print the information that dBASE II has developed, you can place any character or any value exactly where you want it on the page using a simple dBASE II command (you're going to wonder why you have all those other languages) because it gives you full X-Y control. Unlike other systems, dBASE II doesn't make you change the way you do business and lets you use your existing forms.

It's all at your fingertips.

Call or write Ashton-Tate, 3600 Wilshire Boulevard, Los Angeles, CA 90010 (213) 666-4409 for your copy.

We'll send you an original.

You'll wonder how you managed without it.

dBASE II

```
REPORT FORM Jobcosts TO PRINT FOR Job Nmbr=770

PAGE NO  00001
01/27/81
                    COST SUMMARY

  DATE      SUPPLIER          DESCRIPTION      AMOUNT

800615   WICKHAM, GLEN     COPYWRITING        350 00
800704   SHUTTERBUG INC    PHOTOGRAPHY        235 00
800822   LETTER PHONT      TYPE               277 00
800818   GRAPHIC PRINTING  MAILER            1605 00
800915   HARDLINE LITHO    STATS               37 10
800915   MARSHALL, RALPH   LAYOUT             300 00
801004   SHUTTERBUG INC    PHOTOGRAPHY        565 00
811009   MAGIC TOUCH       RETOUCHING         156 00
00 TOTAL 00
                                            2825 10
```

Months worth of data can be organized in minutes with a simple one-line command.

```
CONTENTS

Part I

Introduction
System Requirements
dBASE II Specifications
Database Basics
dBASE II Records, Files and Data Types

Part II

Getting it up
How to CREATE a file
Working with multiple databases (USE, SELECT, CLEAR)
Checking the structure
Modifying your database structure (the MODIFY command)
Entering data (the APPEND command)
Looking at the records and data (LIST, DISPLAY, ?)
Making changes to data and records (EDIT, INSERT,
                                    DELETE, RECALL, PACK)
Full Screen Editing Features

Part III

Using expressions for selection and control
      (field and memory variables, constants, operators)
dBASE II Operations
Expanding your control with functions
Modifying data rapidly (CHANGE, REPLACE)
Merging records and files (APPEND, UPDATE)
JOINing entire databases
Dealing with foreign files (using data you already have)
Renaming and restructuring the database (COPY, MODIFY,
                                    APPEND, RENAME)
Organizing your databases (SORT, INDEX)
Positioning commands (SKIP, GO or GOTO, LOCATE, FIND)
Generally useful system commands
Changing dBASE II characteristics (SET)

Part IV

Getting information out of all that data (REPORT)
How to automate your data into information
                    (CMD command files, DO, RETURN)
A few words about programming and
                    planning your command files
dBASE II command structures (IF..ELSE..ENDIF,
                    DO WHILE, LOOP, ENDDO, CANCEL)
Working with memory variables
          (STORE and  RELEASE, SAVE and RESTORE)
Automatic counting and summing (COUNT, SUM, TOTAL)
Entering data interactively during a run
                              (WAIT, INPUT, ACCEPT)
```

No software is worth its disk space if you can't use it, so dBASE II comes with the most thorough documentation you've ever seen. (Partial Table of Contents shown.)

dBASE II COMMANDS

CREATING FILES
- CREATE sets up new structured databases
- COPY copies databases, their structures, or their data to a new file
- REPORT generates information to your specifications, selecting only the information you want, with or without totals and sub-totals
- SAVE copies memory variables to a file for later use
- INDEX creates an index file for faster data location

ADDING DATA
- APPEND adds records onto the end of a database
- CREATE allows data entry when the file is created
- INSERT puts records into a file

EDITING DATA
- EDIT alters specific database records and fields
- REPLACE changes the contents of specified fields
- CHANGE edits specified fields in the database
- DELETE marks records for deletion
- RECALL erases the deletion mark
- PACK deletes the marked records

DISPLAYING DATA
- DISPLAY and LIST show records, fields and expressions
- ? shows the value of variables or expressions
- REPORT formats and displays data according to specifications, with or without totals
- READ shows prompting information and data
- SUM totals the fields you specify in a database
- TOTAL totals specified fields to a new database

FILE MANIPULATION
- DO starts execution of a command file sequence
- APPEND adds data from other files (even non-dBASE II)
- SELECT switches between two databases in use
- SORT organizes the database sorted on a field

MEMORY VARIABLE COMMANDS
- ACCEPT stores character data for later use
- INPUT accepts character, numeric or logical data
- WAIT accepts a single character input
- GET works like the INPUT command, used in the interactive full-screen entry mode
- SUM saves totals to memory variables
- SAVE stores memory variables in a disk file
- RESTORE retrieves the stored memory variables

OTHER COMMANDS
- FIND locates an indexed record, typically in less than 2 seconds
- LOCATE finds records that meet specified conditions
- SKIP moves you forward or back in the database
- DO WHILE allows repetitive operations
- IF....ELSE allows you to make choices

SYSTEM REQUIREMENTS

dBASE II requires the following hardware and software environments:
- 8080, 8085 or Z-80 based microprocessor system (Like the TRS-80/II, Northstar, Apple II with the Z-80 card, etc.)
- 48K bytes minimum of memory (dBASE II uses locations from 5CH to A400H)
- CP/M operating system (version 1.4 or 2.x)
- One or more mass storage devices operating under CP/M (usually floppy disk drives)
- A cursor addressable 24 line by 80 column CRT if full screen operations are to be used
- Optional text printer (for some commands)

dBASE II SPECIFICATIONS

Records per database file	65535 max
Characters per record	1000 max
Fields per record	32 max
Characters per fields	254 max
Largest number	$\pm 1.8 \times 10^{63}$ approx
Smallest number	$\pm 1 \times 10^{-63}$ approx
Numeric accuracy	10 digits
Character string length	254 characters max
Command line length	254 characters max
Report header length	254 characters max
Index key length	100 characters max
Expressions in SUM command	5 max

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Glossary of Data Communication Terms

ACK — A transmission control character transmitted by a receiver as an affirmative response to the sender.

Accoustic Coupler — A device that converts electrical signals into audio signals, enabling data to be transmitted over the public telephone net-work via a conventional telephone handset.

Address — A coded representation of the origin or destination of data.

ANSI (American National Standards Institute) — The principal standards development body in the USA. ANSI is a non-profit, non-governmental body supported by over 1000 trade organizations, professional societies, and companies. USA's member body to ISO (International Standards Organization).

ARQ (Automatic Request for Repetition) — The ARQ character sequence allows for automatic retransmission on error.

ASCII (American Standard Code for Information Interchange) — Pronounced 'asky'. This is a seven-bit-plus-parity code established by ANSI to achieve compatibility between data services.

Asynchronous Transmission — Transmission in which time intervals between transmitted characters may be of unequal length. Transmission is controlled by start and stop bits at the beginning of each character.

Attenuation — The decrease in magnitude of a signal.

Baud — Unit of signaling speed. The speed in Baud is the number of discrete conditions or signal events per second. If each signal event represents only one bit condition, Baud rate equals bps. When each signal event represents other than one bit, e.g. dibit, Baud rate does not equal bps.

Baudot — Data transmission code in which five bits represent one character. Use of letters/figures Shift enables 64 alphanumeric characters to be represented. Baudot is used in many Teleprinter systems with one start bit and 1.42 stop bits added.

BCC (Block Check Character) — The result of a transmission verification algorithm accumulated over a transmission block, and normally appended at the end; e.g. CRC, LRC.

BEL — A control character that is used when there is a need to call for attention; it may control alarm or attention devices.

Bell 103 — AT&T modem providing asynchronous originate/answer transmission at speeds to 300 bps.

Bell 113 — Same as Bell 103, but provides originate or answer capability only.

Bell 201 — AT&T modem providing synchronous data transmission at 2400 bps.

Bell 202 — AT&T modem providing asynchronous data transmission at speeds to 1800 bps. Requires four-wire line for full duplex operation.

Bell 208 — AT&T modem providing synchronous data transmission at 4800 bps.

Bell 209 — AT&T modem providing synchronous data transmission at 9600 bps.

Bell 212 — AT&T modem providing full duplex asynchronous or synchronous data transmission at speeds to 1200 bps on the dial network.

Bell 43401 — Bell publication which defines requirements for data transmission over limited distance DC-continuous private metallic circuits supplied by the telephone company.

Bisynchronous Transmission (BSC) — An IBM communications protocol which uses a defined set of control characters for synchronized transmission of binary coded data between stations in a data communications system.

Bit (Binary Digit) — Contraction of "binary digit", the smallest unit of information in a binary system. A bit represents the choice between a one or zero condition.

BPS (Bits Per Second) — Unit of data transmission rate.

BS (Backspace) — A format effector which moves the active position one character backward on the same line.

Buffer — A storage device used to compensate for a difference in rate of data flow or event timing when transmitting data from one device to another.

BUS — One or more conductors used for transmitting signals, data, or power. Often a bus acts as a common connection between several locations.

Byte — A binary element string operated upon as a unit and usually shorter than a computer "word". Eight-bit bytes are most common. Also called a "character".

CAN (Cancel) — A character indicating that the data preceding it is in error, and should be ignored.

CCITT (Comite Consultatif Internationale de Telegraphie et Telephonie) — An international consultative committee that sets international communications standards.

Clock — Shorthand term for the source(s) of timing signals used in synchronous transmission. More generally: the source(s) of timing signals sequencing electronic events.

Composite Link — The line or circuit connecting a pair of multiplexors or concentrators; the circuit carrying multiplexed data.

Concentrator (Statistical Multiplexor) — A device used to divide a data channel into two or more channels of lower average speed, dynamically allocating channel space according to demand in order to maximize throughput.

Conditioning — The addition of equipment to a leased voice-grade channel to provide minimum values of line characteristics required for data transmission.

Console — The part of a computer used for communication between the operator or maintenance engineer and the computer.

Contention — The facility provided by the dial network or a port selector which allows multiple terminals to compete on a first-come-first-served basis for a smaller number of computer ports.

CPU (Central Processing Unit) — Portion of a computer which directs the sequence of operations and initiates the proper commands to the computer for execution.

CR (Carriage Return) — A format effector which moves the active position to the first character position of the same line.

CRC (Cyclic Redundancy Check) — An error detection scheme in which the check character is generated by taking the remainder after dividing all the serialized bits in a block by a predetermined binary number.

CTS (Clear To Send) — Physical modem *interface control* signal from data communication equipment (DCE) that indicates to the data terminal equipment (DTE) that it may begin data transmission.

Current Loop — Method of interconnecting terminals and transmitting signals, whereby a mark (binary 1) is represented by current on the line and a space (binary 0) is represented by the absence of current.

DC (Device Control) — A category of control characters primarily intended for turning on or off a subordinate device. Samples of DC characters are: DC1, DC2, DC3 etc. See (X-ON and X-OFF)

DCE (Data Communications Equipment) — The equipment that provides the functions required to establish, maintain, and terminate a data transmission connection; e.g. a modem.

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GLOSSARY

Dibit — A group of two bits. The four possible states for a dibit code are 00, 01, 10, and 11.

DSR (Data Set Ready) — Physical modem interface control signal from the DCE which indicates to the attached terminal equipment that the modem is connected to the telephone circuit.

DTE (Data Terminal Equipment) — The equipment acting as data source, data sink, or both.

DTR (Data Terminal Ready) — Physical modem interface control signal from Data Terminal, indicating to the modem that the terminal is ready for transmission.

EBCDIC (Extended Binary Coded Decimal Interchange Code) — An eight bit character code used primarily in IBM equipment. The code allows for 256 different bit patterns.

Echoplex — A method of checking data transmission accuracy whereby the received data characters are returned to the sending end for comparison with the original data.

EIA (Electronic Industries Association) — A standards organization in the USA specializing in the electrical and functional characteristics of interface equipment.

EM (End of Medium) — A control character that may be used to identify the physical end, used amount, or wanted portion of data recorded on a medium.

Emulate — To imitate a computer system by a combination of hardware and software that allows programs written for one computer to run on another.

ENQ (Enquiry) — A transmission control character used as a request for a response from a remote station.

EOT (End of Transmission) — A transmission control character used to indicate the conclusion of the transmission of one or more texts.

ESC (Escape) — A control character which is used to provide additional control functions. It alters the meaning of a limited number of contiguously following bit combinations.

ETB (End of Transmission Block) — A transmission control character used to indicate the end of a transmission block of data, where data is divided into such blocks for transmission purposes.

ETX (End of Text) — A transmission control character which terminates a text.

FE (Format Effectors) — Category of control characters mainly intended for the control of the layout and positioning of information on printing and/or display devices. Samples of FE characters are: BS, CR, FF, HT, LF, and VT.

FF (Form Feed) — A format effector which advances the active position to the same character position on a predetermined line on the next form or page.

Figures Shift (FIGS) — A physical shift in a terminal using Baudot code which enables the printing of numbers, symbols, upper case characters, etc.

Frequency Division Multiplexor — A device which divides the available transmission frequency range into narrower bands, each of which is used for a separate channel.

FS (File Separator, IS4) — A control character used to separate and qualify data logically; normally delimits data item called a file.

Full Duplex — Simultaneous, two-way, independent transmission in both directions.

GS (Group Separator, IS3) — A control character used to separate and qualify data logically; normally delimits data item called a group.

Half Duplex — Transmission in either direction but not both directions simultaneously.

Handshaking — Exchange of predetermined signals between two devices for purposes of control.

HDLC (High Level Data Link Control) — The international standard communication protocol defined by ISO.

Header — The control information prefixed in a message text, e.g., source or destination address, sequence number or message length or type.

Hexadecimal Number System — The number system with the base of sixteen. In hexadecimal, the first nine digits are 0-9 and the last six digits are represented by the letters A-F.

HT (Horizontal Tabulation) — A format effector which advances the active position to the next pre-determined character position on the same line.

Interleave — To send blocks of data alternately to two or more stations on a multipoint system or to put bits or characters alternately into the time slots in a TDM (Time Division Multiplexor).

IS (Information Separator) — A category of control characters used to separate and qualify data logically; its specific meaning has to be defined for each application. Samples of IS characters are: IS1(US), IS2(RS), IS3(GS), and IS4(FS).

ISO — International Standards Organization

ITB (Intermediate Block Character) — A transmission control character that terminates an intermediate block. A Block Check Character (BCC) usually follows. Use of ITBs allows for error checking of smaller transmission blocks.

LED (Light Emitting Diode) — A semiconductor light source that emits visible light or invisible infrared radiation.

Letters Shift — A physical shift in a terminal using Baudot code which enables the printing of alphabetic characters.

LF (Line Feed) — A format effector which advances the active position to the same character position of the next line.

Line Driver — A signal converter which conditions a digital signal to ensure reliable transmission over an extended distance.

Line Turnaround — The reversing of transmission direction from sender to receiver or vice versa when using a half-duplex circuit.

Loaded Line — A telephone line equipped with loading coils to add inductance in order to minimize amplitude distortion.

LRC (Longitudinal Redundancy Check) — An error detection scheme in which the check character consists of bits calculated on the basis of odd and even parity on all the characters of the block.

Mnemonic Code — Instructions for the computer written in a form that is easy for the programmer to remember. A program written in mnemonics must be converted to machine code prior to execution.

Modem (Modulator-Demodulator) — A device used to convert serial digital data from a transmitting terminal to a signal suitable for transmission over a telephone channel or to reconvert the transmitted signal to serial digital data for acceptance by a receiving terminal.

Multiplexor — A device used for division of a transmission facility into two or more subchannels either by splitting the frequency band into narrower bands (frequency division), or by allotting a common channel to several different transmitting devices, one at a time (time division).

Multipoint Line — A single communications line or circuit interconnecting several stations. Use of this type of line usually requires some kind of polling mechanism to address each terminal with a unique address code.

NAK (Negative Acknowledgement) — A transmission control character transmitted by a receiver as a negative response to the sender.

GLOSSARY

NRZ (Non-Return-to-Zero pulse code) — Pulses in alternating directions for sucessive 1 bits; no change from existing bias for 0 bits.

Null Modem — A device that connects two DTE devices directly by emulating the physical connections of a DCE device.

Overhead Bit — A bit other than a data bit, e.g., check bit framing bit, parity bit.

PABX (Private Automatic Branch Exchange) — An automatic exchange installed on the users premises, that provides for the transmission of calls to and from the public telephone network.

Packet — A group of binary digits, including data and call control signals, which is switched as a whole. The packet information is arranged in a specific format.

Parallel Transmission — Byte-wide data transmission that allocates a data line for each bit in a word. Transmission is usually unidirectional.

Parity Check — Addition of noninformation bits to data, making the number of ones in a byte (bit group) either always odd or always even. This permits detection of errors in blocks that have a single error.

Point-To-Point — A connection between two, and only two, terminals/computers.

Polling — Means of terminal control on a multidrop line by sequential inquiry.

PROM (Programmable Read Only Memory) — Non-volatile memory chip that allows a program to reside permanently in a piece of hardware.

Protocol — A formal set of conventions governing the formatting and relative timing of message exchange between two communicating systems.

Queue — A waiting line or area.

Ring Indicator — Modem interface signal defined in RS-232 which indicates to the attached data terminal equipment that an incoming call is present.

RS (Record Separator, IS2) — A control character used to separate and qualify data logically; it usually delimits a data item called a record.

RS-232C — Interface between data terminal equipment and data communication equipment employing serial binary data interchange.

RS-422 — Electrical characteristics of balanced-voltage digital interface circuits.

RS-423 — Electrical characteristics of unbalanced-voltage digital interface circuits.

RS-449 — General purpose 37 pin and 9 pin interface for data terminal equipment and data circuit-terminating equipment employing serial binary data interchange.

RTS (Request To Send) — Physical modem interface control signal from DTE, requesting clearance to transmit.

RVI (Reverse Interrupt) — A transmission control character transmitted by a receiving station to request termination of the current transmission because of another high priority message it must send.

SDLC (Synchronous Data Link Control) — IBM standard communication protocol superseding BSC.

Serial Transmission — A method of data transmission in which each bit of information is sent sequentially on a single data channel. Serial transmission is the normal transmission mode for data communications.

Short Haul Modem — A signal converter which conditions a digital signal to ensure reliable transmission over DC continuous private line metallic circuits without interfering with adjacent pairs in the same telephone cable.

SI (Shift-In) — a control character used in conjunction with SO (Shiftout) and ESC (Escape) to extend the graphic character set of the code.

Simplex Transmission — Data Transmission in one direction only.

SO (Shiftout) — A control character used in conjunction with SI (Shift-In) and ESC (Escape) to extend the graphic character set of the code.

SOH (Start Of Header) — A transmission control character used as the first character of a heading of an information message.

STX (Start of Text) — A transmission control character which precedes a text and which is used to terminate a heading.

SUB (Substitute Character) — A control character used in the place of a character that has been found to be invalid or in error.

Synchronous Transmission — Transmission in which the data characters and bits are transmitted at a fixed rate with the transmitter and receiver synchronized. Synchronous transmission eliminates the need for start and stop bits.

SYN (Synchronous Idle) — A transmission control character used by a synchronous transmission system in the absence of any other character (idle condition), to provide a signal.

Tail Circuit — A feeder circuit or an access line to a network node.

TC (Transmission Control) — Category of control characters intended to control or facilitate transmission of information over telecommunication networks. Samples of TC characters are: ACK, DLE, ENQ, EOT, ETB, ETX, NAK, SOH, STX, and SYN.

TELEX (Teleprinter Exchange) — A teleprinter dial network offered by Western Union and the International Record Carriers. Uses Baudot code.

Time Division Multiplexor (TDM) — A device which derives multiple channels on a single transmission facility by connecting terminals one at a time at regular intervals. It interleaves bits (bit TDM) or characters (character TDM) from each terminal.

TTD (Temporary Text Delay) — The TTD control sequence (STX ENQ) is sent by a sending station in message transfer state when it wants to retain the line but is not ready to transmit.

TWX (Teletypewriter Exchange Service) — A teletypewriter dial network owned by Western Union. ASCII coded machines are used.

V.35 — CCITT standard governing data transmission at 48Kbps using 60-108kHz group band circuits.

VRC (Vertical Redundancy Check) — An error detection scheme in which the parity bit of each character is set to "1" or "0" so that the total number of "1" bits in the character is odd or even.

VT (Vertical Tabulation) — A format effector which advances the active position to the same character position on the next predetermined line.

WACK (Wait Before Transmit) — The WACK character sequence allows a receiving station to indicate a "temporarily not ready to receive" condition to the transmitting station.

X-OFF (Transmitter Off, DC3) — The communication control character used to instruct a terminal to suspend transmission.

X-ON (Transmitter On, DC1) — The communication control character used to instruct a terminal to start or resume transmission.

X.25 — CCITT standard governing interface between data terminal equipment (DTE) and data circuit terminating equipment (DCE) for terminals operating in the packet mode on public data networks.

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TABLES

Pinout Table For EIA RS-449, EIA RS-232C/CCITT V.24

RS-449 Interface					RS-232 Interface				Signal Type & Direction							
	37 PIN									DATA		CONTROL		TIMING	
9 PIN AUX.	A	B	RS449 CIRCUIT	RS449 DESCRIPTION	25 PIN	EIA-RS232C CIRCUIT	CCITT-V.24 CIRCUIT	RS232 DESCRIPTION	GND	From DCE	To DCE	From DCE	To DCE	From DCE	To DCE
1	1			Shield	1	AA	101	Protective Ground	X						
5	19		SG	Signal Ground	7	AB	102	Signal Ground/Common Return	X						
9	37		SC	Send Common			102a	DTE Common	X						
6	20		RC	Receive Common			102b	DCE Common	X						
	4	22	SD	Send Data	2	BA	103	Transmitted Data			X				
	6	24	RD	Receive Data	3	BB	104	Received Data		X					
	7	25	RS	Request to Send	4	CA	105	Request to Send					X		
	9	27	CS	Clear to Send	5	CB	106	Clear to Send				X			
	11	29	DM	Data Mode	6	CC	107	Data Set Ready				X			
	12	30	TR	Terminal Ready	20	CD	108.2	Data Terminal Ready					X		
	15		IC	Incoming Call	22	CE	125	Ring Indicator				X			
	13	31	RR	Receiver Ready	8	CF	109	Received Line Signal Detector				X			
	33		SQ	Signal Quality	21	CG	110	Signal Quality Detector				X			
	16		SR	Signaling Rate Selector	23	CH	111	Data Signal Rate Selector (DTE)					X		
	2		SI	Signaling Rate Indicator	23	CI	112	Data Signal Rate Selector (DCE)				X			
	17	35	TT	Terminal Timing	24	DA	113	Transmitter Signal Element Timing (DTE)							X
	5	23	ST	Send Timing	15	DB	114	Transmitter Signal Element Timing (DCE)						X	
	8	26	RT	Receive Timing	17	DD	115	Receiver Signal Element Timing (DCE)						X	
3			SSD	Secondary Send Data	14	SBA	118	Secondary Transmitted Data			X				
4			SRD	Secondary Receive Data	16	SBB	119	Secondary Received Data		X					
7			SRS	Secondary Request to Send	19	SCA	120	Secondary Request to Send					X		
8			SCS	Secondary Clear to Send	13	SCB	121	Secondary Clear to Send				X			
2			SRR	Secondary Receiver Ready	12	SCF	122	Secondary Received Line Signal Detector				X			
	10		LL	Local Loopback			141	Local Loopback					X		
	14		RL	Remote Loopback			140	Remote Loopback					X		
	18		TM	Test Mode			142	Test Indicator				X			
	32		SS	Select Standby			116	Select Standby					X		
	36		SB	Standby Indicator			117	Standby Indicator				X			
	16		SF	Select Frequency			126	Select Transmit Frequency				X			
	28		IS	Terminal in Service									X		
	34		NS	New Signal									X		

NOTES:
References DB25 (25 pin) connector that is commonly used for RS232 & V.24. Pins 9 & 10 are reserved for data set testing. Pins 11, 18 and 25 are undefined.
Pins 3 & 21 of RS449 interface connector are undefined.
Lead #23 of RS-232 connector may be defined as CH or CI.
37 pin designation B = return.

Universal Code Chart/Hexidecimal Equivalency

Character	8 Bit, No Parity ASCII	7 Bit, No parity, ASCII	Even Parity ASCII	Odd Parity ASCII	EBCDIC	6-Bit Transcode	Baudot*
A	C1	41	C1	C1	01	1F	03
B	C2	42	C2	C2	02	1F	19
C	C3	43	C3	43	C3	03	1F 0E
D	C4	44	44	C4	C4	04	1F 09
E	C5	45	C5	45	C5	05	1F 01
F	C6	46	C6	46	C6	06	1E DD
G	C7	47	47	C7	C7	07	1F 1A
H	C8	48	48	C8	C8	08	1F 14
I	C9	49	C9	49	C9	09	1F 06
J	CA	4A	CA	4A	D1	11	1F 0B
K	CB	4B	4B	CB	D2	12	1F 0F
L	CC	4C	CC	4C	D3	13	1F 12
M	CD	4D	4D	CD	D4	14	1F 1C
N	CE	4E	CE	D5	15	1F	0C
O	CF	4F	CF	4F	D6	16	1F 18
P	D0	50	50	D0	D7	17	1F 16
Q	D1	51	D1	51	D8	18	1F 17
R	D2	52	D2	52	D9	19	1F 0A
S	D3	53	53	D3	E2	22	1F 05
T	D4	54	D4	54	E3	23	1F 10
U	D5	55	55	D5	E4	24	1F 07
V	D6	56	56	D6	E5	25	1F 1E
W	D7	57	D7	57	E6	26	1F 13
X	D8	58	D8	58	E7	27	1F 1D
Y	D9	59	59	D9	E8	28	1F 15
Z	DA	5A	5A	DA	E9	29	1F 11

Character	8 Bit, No Parity ASCII	7 Bit, No parity, ASCII	Even Parity ASCII	Odd Parity ASCII	EBCDIC	6-Bit Transcode	Baudot*
a	E1	61	E1	61	81		
b	E2	62	E2	62	82		
c	E3	63	63	E3	83		
d	E4	64	E4	64	84		
e	E5	65	65	E5	85		
f	E6	66	66	E6	86		
g	E7	67	E7	67	87		
h	E8	68	E8	68	88		
i	E9	69	69	E9	89		
j	EA	6A	6A	EA	91		
k	EB	6B	EB	6B	92		
l	EC	6C	6C	EC	93		
m	ED	6D	ED	6D	94		
n	EE	6E	EE	6E	95		
o	EF	6F	6F	EF	96		
p	F0	70	F0	70	97		
q	F1	71	71	F1	98		
r	F2	72	72	F2	99		
s	F3	73	Fc	73	A2		
t	F4	74	74	F4	A3		
u	F5	75	F5	75	A4		
v	F6	76	F6	76	A5		
w	F7	77	77	F7	A6		
x	F8	78	78	F8	A7		
y	F9	79	F9	79	A8		
z	FA	7A	FA	7A	A9		

Character	8 Bit, No Parity ASCII	7 Bit, No parity, ASCII	Even Parity ASCII	Odd Parity ASCII	EBCDIC	6-Bit Transcode	Baudot*
0	B0	30	30	B0	F0	30	1B 16
1	B1	31	B1	31	F1	31	1B 17
2	B2	32	B2	32	F2	32	1B 13
3	B3	33	33	B3	F3	33	1B 01
4	B4	34	B4	34	F4	34	1B 0A
5	B5	35	35	B5	F5	35	1B 10
6	B6	36	36	B6	F6	36	1B 15
7	B7	37	B7	37	F7	37	1B 07
8	B8	38	B8	38	F8	38	1B 06
9	B9	39	39	B9	F9	39	1B 18
SP	A0	20	A0	20	40	1A	04
!	A1	21	21	A1	5A		
"	A2	22	22	A2	7F		1B 11
#	A3	23	A3	23	7B	3B	1B 14
$	A4	24	24	A4	5B	1B	1B 0D
%	A5	25	A5	25	6C	2C	
&	A6	26	A6	26	50	10	1B 1A
'	A7	27	27	A7	7D		1B 05
(	A8	28	28	A8	4D		1B 0F
)	A9	29	A9	29	5D		1B 12
*	AA	2A	AA	2A	5C	1C	
+	AB	2B	2B	AB	4E		1B 09
,	AC	2C	AC	2C	6B	2B	1B 0C
-	AD	2D	2D	AD	60	20	1B 03
.	AE	2E	2E	AE	4B	0B	1B 1C
/	AF	2F	AF	2F	61	21	1B 1D

Character	8 Bit, No Parity ASCII	7 Bit, No parity, ASCII	Even Parity ASCII	Odd Parity ASCII	EBCDIC	6-Bit Transcode	Baudot*
:	BA	3A	3A	BA	7A		1B 0E
;	BB	3B	BB	3B	5E		1B 1E
<	BC	3C	3C	BC	4C	0C	
=	BD	3D	BD	3D	7E		
>	BE	3E	BE	3E	6E		
?	BF	3F	3F	BF	6F		1B 19
@	C0	40	C0	40	7C	3C	
[	DB	5B	DB	5B			
\	DC	5C	5C	DC	E0		
]	DD	5D	DD	5D			
Δ	DE	5E	DE	5E			
_	DF	5F	5F	DF	6D		
`	FB	7B	7B	FB	C0		
{	FC	7C	FC	7C	6A		
}	FD	7D	7D	FD	D0		
~	FE	7E	7E	FE	A1		
¢					4A		
¬					5F		
¦					4F		
ACK	86	06	06	86	2E		
BEL	87	07	87	07	2F	0D	1B 0B
BS	88	08	88	08	16		
BYP					24		
CAN	98	18	18	98	18		
CC					1A		
CR	8D	0D	8D	0D	0D		08

Character	8 Bit, No Parity ASCII	7 Bit, No parity, ASCII	Even Parity ASCII	Odd Parity ASCII	EBCDIC	6-Bit Transcode	Baudot*
DC1	91	11	11	91	11		
DC2	92	12	12	92	12		
DC3	93	13	93	13	13		
DC4	94	14	14	94	3C		
DEL	FF	7F	FF	7F	07	3F	
DLE	90	10	90	10	10	1F	
DS					20		
EM	99	19	99	19	19	3E	
ENQ	85	05	05	85	2D	2D	
EOB					26		
EOT	84	04	84	04	37	1E	
ESC	9B	1B	1B	9B	27	2A	
ETB	94	17	17	97	26	0F	
ETX	83	03	03	83	03	2E	
FF	8C	0C	0C	8C	0C		
FIG							1B
FS	9C	1C	9C	1C	22		
GS	9D	1D	1D	9D			
HT	89	09	09	89	05	2F	
IFS					1C		
IGS					1D		
IL					17		
IRS					1E		
IUS					1F		

Character	8 Bit, No Parity ASCII	7 Bit, No parity, ASCII	Even Parity ASCII	Odd Parity ASCII	EBCDIC	6-Bit Transcode	Baudot*
LC					06		
LET							1F
LF	8A	0A	0A	8A	25		02
NAK	95	15	95	15	3D	3D	
NL					3D	3D	
NUL	80	00	00	80	00		
PF					04		
PN					34		
PRE					27		
RES					14		
RLF					09		
RS	9E	1E	1E	9E	35		
SI	8F	0F	0F	8F	0F		
SM					2A		
SMM					0A		
SO	8E	0E	8E	0E	0E		
SOH	81	01	81	01	01	00	
SOS					21		
STX	82	02	82	02	02	0A	
SUB	9A	1A	9A	1A	3F	0E	
SYN	96	16	96	16	32	3A	
UC					36		
US	9F	1F	9F	1F		1D	
VT	8B	0B	8B	0B	0B		

*The listing in the Baudot column may be in the form of two hex numbers, in which case the first number designates the LETTERS/FIGURE SHIFT. Where only one hex number is shown, the character is shift independent.

VENDOR	MODEL	WORD SIZE (in bits)	RAM CAPACITY	ROM CAPACITY	OPERATING SYSTEM	PROGRAMMING LANGUAGES	SOFTWARE PACKAGES	FEATURES (including communications protocols)	PRICE OF HARDWARE (excluding printer)
Access Matrix Corp. Circle 311	Access	8	64Kb	4Kb EPROM, character set EPROM	CP/M	M-Basic, C-Basic	PerfectWriter; PerfectSpeller; PerfectFiler; PerfectCalc; Fancy Font; Communications	Built-in 80cps dot matrix printer; direct connect modem and acoustic coupler; 7" screen; detachable keyboard; dual 5¼" double-density disk drives; six I/O ports	$2495 (printer standard)
Albert Computers Circle 312	Albert	8	64Kb to 192Kb		Apple DOS	Basic, CP/M	All packages that run on Apple II, II+ and IIe; five packages from ArtSci	RS232 communications; RS422/423 network communications; parallel and serial printer ports; voice recognition and command; digitized audio control and output	$1595
Alspa Computer Circle 313	AC-1	8	64Kb	2Kb	CP/M 2.2	CP/M	Alspa System Utility Package	Three serial I/O ports; parallel printer port; hard disk port; one single- or double-sided 8" disk drive (596Kb or 1.2Mb storage)	$1995 (single-sided drive); $2495 (double-sided drive)
	AC-2	8	64Kb	2Kb	CP/M 2.2	CP/M	Alspa System Utility Package	Three serial I/O ports; parallel printer port; hard disk port; dual single- or double-sided 8" disk drives (1.19Mb or 2.4Mb storage)	$2995 (single-sided drive); $3695 (double-sided drive)
Altos Circle 314	580-10	8	192Kb	4Kb to 64Kb	CP/M, MP/M, OASIS Multiuser	C-Basic, MS-Basic, MS-Cobol, RM/Cobol, MT and Pascal, MS-Fortran, CIS-Cobol, Altos Business Basic III, C-Basic Compiler, CB-80, MS-Basic Compiler	WP; financial planner; accounting	3270 cluster terminal controller/emulator; asynch communications	$5990
	586-10	16	512Kb	4Kb to 64Kb	Xenix, MP/M-86, PICK, OASIS-16	MS-Basic Interpreter, MS-Basic Compiler, C-Basic 16, Business Basic III, RM/Cobol, Level II Cobol, MS-Pascal, Softbol, MS-Fortran, Fortran 77	WP; financial planner; accounting; DBMS; file management	3270 cluster terminal controller/emulator; 3780 and SNA/SDLC bisynch communications; Ethernet; Altos-Net; 10Mb hard disk storage	$7990
	586-40	16	512Kb	4Kb to 64Kb	Xenix, MP/M-86, PICK, OASIS-16	Same as 586-10	Same as 586-10	Same as 586-10, except with 40Mb hard disk storage	$10,990
Apple Computer Circle 315	IIe	8	64Kb to 128Kb	16Kb	DOS	Basic, Pascal, Fortran	WP; financial; electronic mail	6502A microprocessor; color graphics; D-9 connectors	$1395
	III	8	256Kb	4Kb	SOS	Basic, Cobol, Pascal, Assembly	WP; financial; electronic mail	6502B microprocessor; dual D-B9 connectors; built-in disk drive; ASCII keyboard	$2695
	Lisa	32	1Mb	16Kb	Lisa (UNIX-like), XENIX, Uni-Pius	Basic-Plus, Pascal, Cobol, APL, C, Fortran	LisaWrite; LisaDraw; LisaGraph; LisaCalc; LisaProject; LisaList; LisaTerminal; accounting; open systems	Asynch VT52 and VT100, and 3270 SNA/BSC communications; dual floppy disk drives (860Kb formatted storage each); 5Mb Winchester disk	$6995
Applied Digital Data Systems Circle 316	Multivision I	8	64Kb	4Kb	MUON (CP/M-compatible, single user)	Basic Compiler, Basic Interpreter, Basic ISAM, Cobol, Fortran	WP; Microplan; third-party ASCOM	Two parallel printer ports; two RS232 serial ports; asynch and bisynch communications; dual mini disk drives	$3395
	Multivision 8-5/8-15 S	8	64Kb	4Kb	MUON (single user)	Basic Compiler, Basic Interpreter, Basic ISAM, Cobol, Fortran	WP; Microplan; third-party ASCOM	Mini disk drive (800Kb); 5Mb or 15Mb hard disk drive	$5995 to $7195
	Multivision 8-5/8-15 M	8	256Kb	4Kb	MUON (multi-user)	Basic Compiler, Basic Interpreter, Basic ISAM, Cobol, Fortran	WP; Microplan; third-party ASCOM	Multi-user capabilities; four serial asynch RS232 ports	$6745 to $7945
	Multivision II	8	64Kb	4Kb	MUON (single user)	Basic Compiler, Basic Interpreter, Basic ISAM, Cobol, Fortran	WP; Microplan; third-party ASCOM	Dual mini disk drives (300Kb each); 10Mb hard disk drive	$8205
	Multivision III	8	256Kb	4Kb	MUON (multi-user)	Basic Compiler, Basic Interpreter, Basic ISAM, Cobol, Fortran	WP; Microplan; third-party ASCOM	Supports up to four users; expandable module; four serial asynch RS232 ports	$9705 to $10,705
ATV Systems Circle 317	HM-I	8	80Kb	12Kb	CP/M	Basic, Fortran, Cobol, APL, Pascal, Macro Assembler	WP; accounting; electronic spreadsheet; spelling; mailing list; DBMS	Dual 800Kb floppy disks; 10Mb and 16Mb 5¼" Winchester disks; three RS232C ports; asynch/bisynch communications	From $8900
Burroughs Corp. Circle 319	B21 Series	16	256Kb to 512Kb	4Kb	BTOS	Basic, Cobol, Fortran, Pascal	WRITEone WP; Multiplan; Business Graphics; Data Manager; Executive Accounting System	Multi-user; 2780/3780 and 3270 bisynch communications; 1Mb 5¼" diskettes; 5Mb to 15Mb Winchester disk	$2995 to $10,145
	B22 Series	16	256Kb to 640Kb	4Kb	BTOS	Basic, Cobol, Fortran, Pascal	Same as B21 Series	Multi-user; 2780/3780 and 3270 bisynch communications; 800Kb 8" diskette; 60Mb Winchester disks	$4595 to $25,090

C.A.T. III	8	96Kb	4Kb	Proprietary	CADOL	Over 300 packages available	Desktop; expandable to four ports; asynch and bisynch communications; up to 15Mb storage	From $5995
System 20/20	8	96Kb	4Kb	Proprietary	CADOL	Over 300 packages available	Asynch and bisynch communications; up to 52Mb storage; supports up to two CPUs; four- or eight-port capability	From $11,000
Tiger ATS 64	16	40Kb, 64Kb, 128Kb, 1024Kb	16Kb and 32Kb PROM	CADO Multi-Master/Interpretive Operating System (MM/IOS)	CADOL, Level II Cobol	Over 300 packages available	Supermicro system with multiple interactive processors to support up to 64 terminals; asynch and bisynch communications; up to 1.1Mb direct addressable memory	From $31,400
AS100M	16	64Kb dynamic	8Kb	MS-DOS, CP/M-86	Canon-Basic, GW-Basic, Level I Cobol, RM/Cobol, Pascal, Fortran	WordStar; MailMerge; SpellStar; CalcStar; InfoStar	128Kb memory; monochrome display; Centronics-type parallel interface	$2325
AS100C	16	64Kb dynamic	8Kb	MS-DOS, CP/M-86	Canon-Basic, GW-Basic, Level I Cobol, RM/Cobol, Pascal, Fortran	WordStar; MailMerge; SpellStar; CalcStar; InfoStar	128Kb memory; color display; Centronics-type parallel interface	$3025
1600-VP	16	128Kb to 256Kb	12Kb	CP/M-86, MS-DOS	Basic, Assembler, Cobol, C, Macro 86, MS-Pascal 86 and 87, MS-Fortran 86 and 87	Perfect Writer; Perfect Speller; Perfect Calc; Perfect Filer; Fast Graphs; communications	RS232 asynch communications. Centronics parallel port; X-on and X-off protocol	$2995
1600-1	16	128Kb	12Kb	CP/M-86, MS-DOS	Same as 1600-VP	Same as 1600-VP	Same as 1600-VP	$3395
1600-4	16	128Kb	12Kb	CP/M-86, MS-DOS, MP/M-86	Same as 1600-VP	Same as 1600-VP	Same as 1600-VP	$4595
PET	8	32Kb	18Kb	Proprietary	Basic 4.0, 6502 ASM		Nine-digit floating binary arithmetic numeric pad	N/A
64	8	64Kb	20Kb	Proprietary DOS, CP/M	Basic 2.0, Cobol, Fortran	EasyScript; EasyFinance; EasyMail; EasySpell	Color display; modem	N/A
CBM	8	32Kb to 96Kb	18Kb	Proprietary	MS-Basic 4.0, 6502 Assembler	WP; accounting; spreadsheet	RS232 and IEEE-488 Grib ports	N/A
SuperPET	8	96Kb to 134Kb	36Kb	Proprietary	Waterloo MicroAPL, Waterloo MicroBasic, Waterloo MicroCobol, Waterloo MicroFortran, Waterloo MicroPascal, Waterloo MicroAssembler, Waterloo MicroEditor	WP; accounting; spreadsheet	RS232 and IEEE-488 Grib ports	N/A
Electric Briefcase	8	64Kb	4Kb to 8Kb	CP/M	Basic, Assembler, CP/M-compatible languages	WP; accounting; data manager; spreadsheet; dictionary; legal billing	Portable. TTY and 2780/3780 communications	$1995 to $2495
8200	8	128Kb to 256Kb	8Kb	CP/M Extended	Basic, Assembler, CP/M-compatible languages	WP; accounting; data manager; spreadsheet; dictionary; legal billing	Multiterminal system; TTY, 2780/3780, 3270 and VT100 communications; 10Mb and 32Mb disk storage	$13,500 to $22,500
Compaq Portable Computer	16	128Kb to 256Kb	8Kb	MS-DOS	Compaq-Basic	All major business and professional packages for the IBM PC	Portable; 9" CRT; IBM-compatible high-resolution graphics with RGB monitor connector; detachable keyboard	$2995
Omega-Mite	8 and 16	64Kb to 256Kb	2Kb	CP/M, MS-DOS, proprietary	Basic, Assembly, Fortran, Cobol	WP; electronic spreadsheet; graphics; CP/M and MS-DOS compatible packages	Asynch communications; attaches to OmegaNet local area network; 655Kb floppy disk drive; acoustic coupler	From under $3000
775	8	64Kb to 256Kb	4Kb	CP/M, proprietary	Assembler, Fortran, Basic	WP; accounting; network		$7620
785	8	64Kb to 256Kb	4Kb	CP/M, proprietary	Assembler, Fortran, Basic	Same as 775	Supports up to three 5Mb Winchester disks	$10,495
790	8	64Kb to 256Kb	4Kb	CP/M, proprietary	Assembler, Fortran, Basic	Same as 775	Supports up to three 10Mb Winchester disks	$11,995
795	8	64Kb to 256Kb	4Kb	CP/M, proprietary	Assembler, Fortran, Basic	Same as 775	Supports up to three 15Mb Winchester disks	$13,495
799	8	64Kb to 256Kb	4Kb	CP/M, proprietary	Assembler, Fortran, Basic	Same as 775	Supports up to three 15Mb Winchester disks	$22,995
MP-10	8 and 16	1Mb		MP/M-8/16	Basic, Cobol, Assembly, Pascal	WP; DBMS; spreadsheet; accounting	Networking; solid-state disk; SNA protocol	$4995
Omnix-2	16	128Kb	16Kb	Opus-1	Trans-Basic	IAS (integrated accounting system)	Dual 1Mb 5¼" floppy disks; supports up to four users; can support up to three *OmniView* CRTs and one Omni-Print-3 printer	$5490 to $8000
Omnix 5-1, 10-1, 15-1, 20-1, 40-1	16	128Kb	16Kb	Opus-1	Trans-Basic	IAS	1Mb 5¼" floppy disk; 10Mb 5¼" Winchester disk; supports up to eight users	$7490 to $16,000

VENDOR	MODEL								
Computer Automation (continued) Circle 329	Omnix-186	16	384Kb	16Kb	Opus-1, CP/M-86, MP/M-86, OASIS-16, Concurrent CP/M	Trans-Basic, C-Basic 86, Cobol	IAS; MP/M-86 and OASIS-16 compatible applications	1Mb 5¼" floppy disk; 40Mb 5¼" Winchester disk; supports up to 16 users	$8990 to $17,000
Computer Design and Systems Circle 329	Micro Plus	8 and 16	512Kb	1Kb	CP/M 2.2 and 3.0	M-Basic, Cobol, Basic Compiler, Fortran, Pascal, Pilot	Accounts payable and receivable; general ledger; payroll; inventory	Asynch communications; RS232 interface; .5Mb to 16Mb disk storage	$3600 to $7200
Computer Systems Circle 330	PC/8088	16	64Kb to 512Kb	32Kb to 64Kb	MS-DOS, CP/M-86	Basic, Cobol, C, Forth, Fortran, Pascal	WP; spreadsheet; graphics; data base; IBM communications	IBM-compatible; dual disk drives; optional RS232C interface, keyboard and Winchester disk (up from 40Mb)	From $1488
Computer Transceiver Systems Circle 331	Execuport XL	8 and 16	80Kb to 512Kb		CP/M 2.2, MS-DOS, CP/M-86		Perfect Calc; Perfect Speller; Perfect Writer; Perfect Filer	Dual 5¼" floppy disk drives (400Kb formatted capacity each); 44 user-defined functions	From $2495
Convergent Technologies Circle 332	Mega-frame	16	28Mb		CTIX (UNIX System 5)	Cobol, Fortran 77, Pascal, Basic, C	WP; spreadsheet; ISAM; DBMS; UNIX Utilities	IBM 3270 (BSC and SNA), 2780/3780, 3770 and CCITT X.25	N/A
Cromemco Circle 333	C-10SP	8	64Kb	24Kb	C-DOS	Basic	WriteMaster; PlanMaster	Detachable keyboard; RS232 serial data communications port; parallel Centronics printer port; serial printer interface port; 25-line display	$1785
	CS1D2	8 and 16	256Kb to 2Mb	Expandable in 32Kb increments	Cromix, C-DOS	Basic, Fortran 77, Cobol, Pascal, C, Ratfor, Lisp, RPG II	WP; financial planning	Dual processor; expandable bus structure; dual 5¼" floppy disk drives	$4995
Data General Corp. Circle 405	Model 10	16	256Kb to 768Kb		DG AOS, DG RDOS, CP/M-86, MS-DOS	Dependent on operating system chosen	DG CEO, plus any software supported by operating system	Tightly coupled dual processors; multiterminal; both personal and data base processing	From $3165
	Model 10/SP	16	256Kb to 768Kb		Same as Model 10	Same as Model 10	Same as Model 10	Same as Model 10, plus floating-point instructional set	From $9660
	Model 20	16	256Kb to 512Kb		DG RDOS	Extended Basic, Business Basic, Interactive Cobol, RPG	CEO, plus all DG RDOS software	Both personal and data base processing	From $10,640
	Model 30	16	256Kb to 1.5Mb		DG AOS	Same as Model 20	CEO, plus all DG AOS software	Technical and business computing	From $17,030
Datapoint Corp. Circle 334	1560	8	128Kb	12Kb	DOS.H, CP/M	Databus, Datashare, Fortran, BasicPlus	WP; electronic message services; Multiplan	ARCNET interface; 3270, SNA/SDLC, 2780, 3780, HDLC and TTY emulation; Datapoint terminal support	$3195
Digilog Business Systems Circle 335	DBS 16	16	512Kb (single user); 3.5Mb (multi-user)		CP/M-86, MS-DOS, MP/M-86	Basic, Fortran, Pascal, Cobol		Can support up to 16 users; multiprocessors, each supporting one to four users; multibus architecture	From $4595
Digital Equipment Corp. Circle 336	Rainbow 100	8 or 16	64Kb		CP/M		Multiplan; list manager; Select; CP/M; communications	RS232 interface	$3800
	DECmate Office Workstation	12	96Kb		CP/M 2.0, COS310, WPS-8	Basic, Dibol, Cobol	Daisy-Aids; graphics; BPI and Multiplan spreadsheet; WPS 1.1	CP/M-to-WP conversion utility; Easycom multiple access; can support 10Mb Winchester disk	$4735
Dimis Micro Systems Circle 337	Model 10	8	56Kb		Northstar DOS, CP/M	Northstar Basic	WP; client programmed accounting; medical and dental accounting	Upgradeable to 8/16 bits; networking capability	$2995
Direct Circle 338	1031	8	64Kb compatible; 64Kb (display)		CP/M-80	Basic, 2-80 Assembler	WordStar; SuperCalc	DEC VT100/52 and ANSI 3.64 personality; programmable function keys; dual 5¼" diskettes (600Kb or 1.2Mb)	$3450
	1025	8	64Kb compatible; 64Kb (display)		CP/M-80	Basic, 2-80 Assembler	WordStar; SuperCalc	HP terminal personality; programmable function keys; dual 5¼" diskettes (600Kb or 1.2Mb)	$3995
	1625	16	128Kb compatible; 64Kb (display)		MS-DOS, optional CP/M-80 and CP/M-86	Basic	WordStar; SuperCalc; Multiplan; MultiFile	HP terminal personality; programmable function keys; dual 5¼" diskettes (600Kb storage)	$3995
	1631	16	128Kb compatible; 64Kb (display)		MS-DOS, optional CP/M-80 and CP/M-86	Basic	WordStar; SuperCalc; Multiplan; MultiFile	DEC VT100/52 and ANSI 3.64 personality; programmable function keys; dual 5¼" diskettes (600Kb storage)	$3995
Durango Systems Circle 339	Poppy-52	16	640Kb		MS-DOS, CP/M-86	M-Basic, C, Fortran, Cobol, Pascal, SMC-Basic	Productivity applications; industry-specific packages	819Kb diskette storage; multiple communications ports; parallel I/O port; up to seven RS232 or 422 interface ports	$4395
	Poppy-53	16	640Kb		MS-DOS, CP/M-86	M-Basic, C, Fortran, Cobol, Pascal, SMC-Basic	Productivity applications; industry-specific packages	Same as Poppy-52, plus 10.6Mb fixed disk storage	$5995
	Poppy-54	16	640Kb		MS-DOS, CP/M-86	M-Basic, C, Fortran, Cobol, Pascal, SMC-Basic	Productivity applications; industry-specific packages	Same as Poppy-52, plus 21.3Mb fixed disk storage	$7495

VENDOR	MODEL	WORD SIZE (in bits)	RAM CAPACITY	ROM CAPACITY	OPERATING SYSTEM	PROGRAMMING LANGUAGES	SOFTWARE PACKAGES	FEATURES (including communications protocols)	PRICE OF HARDWARE (excluding printer)
Durango (continued)	801	8	192Kb		DX85M, CP/M-80	Star Basic	Productivity applications; industry-specific packages	Supports up to four users; 2Mb diskette storage; multiple communications ports	$7695
	901	8	192Kb		DX85M, CP/M-80	Star Basic	Productivity applications; industry-specific packages	Same as 801, plus 10.3Mb fixed disk storage	$9665
	Poppy-101	16	1152Kb		Xenex, MS-DOS, CP/M-86	M-Basic, C, Fortran, Cobol, Pascal, SMC-Basic	Productivity applications; industry-specific packages	819Kb diskette storage; 10.6Mb fixed disk storage; multiple communications ports; parallel I/O port; dual processors	$9975
	Poppy-102	16	1152Kb		Xenex, MS-DOS, CP/M-86	M-Basic, C, Fortran, Cobol, Pascal, SMC-Basic	Productivity applications; industry-specific packages	Same as Poppy-101	$10,975
	911	8	192Kb		DX85M, CP/M-80	Star Basic	Productivity applications; industry-specific packages	Supports up to four users; 2Mb diskette storage; 21.3Mb fixed disk storage; multiple communications ports	$11,195
	Poppy-103	16	1152Kb		Xenex, MS-DOS, CP/M-86	M-Basic, C, Fortran, Cobol, Pascal, SMC-Basic	Productivity applications; industry-specific packages	819Kb diskette storage; 21.3Mb fixed disk storage; multiple communications ports; parallel I/O port; dual processors	$12,475
E&L Instruments Circle 340	Fox	8	4Kb	8Kb	Proprietary	Machine		Fundamental trainer; seven segment readouts; Z-80 based; course material available	$399
	MMD-2	8	4Kb	8Kb	Proprietary	Machine, Basic	Basic	Advanced trainer; seven segment readouts; 8080 based; PROM programmer on board	$1550
Eagle Computer Circle 341	IIE	8	64Kb		CP/M	C-Basic	WP; spreadsheet		$1595 to $3995
	PC	16	64Kb to 512Kb		MS-DOS	GW-Basic	WP; spreadsheet		$1995 to $4495
	1600	16	128Kb to 512Kb		MS-DOS	GW-Basic	WP; spreadsheet; optional accounting		$4495 to $8995
EXO Systems Corp. Circle 342	Avalanche 200	8 or 16	64Kb	8Kb	CP/M, EXO/Net	Basic, Cobol, PL1	CP/M	Standard networking capability	$1295
	Avalanche 400	8 or 16	64Kb to 256Kb	8Kb	CP/M, EXO/Net	Basic, Cobol, PL1	CP/M	Standard networking capability	$4495
	Avalanche 500	8 or 16	64Kb to 256Kb	8Kb	CP/M, EXO/Net	Basic, Cobol, PL1	CP/M	Standard networking capability	$5995
	Avalanche 700	8 or 16	64Kb to 256Kb	8Kb	CP/M, EXO/Net	Basic, Cobol, PL1	CP/M	Standard networking capability	$7995
Exxon Office Systems Co. Circle 343	8400 Controller	8	512Kb to 2Mb		UNIX	UNIX, CP/M	Time management	Attaches to firm's 500 Series workstations; electronic mail; security; glossary; TTY, asynch and 2780/3780 emulation	$15,000 to $31,500
Facit Circle 344	6500 Series	8	64Kb to 160Kb	32Kb	Facit-DOS CP/M 2.2	Basic	WP; data base; Calc; Diagram; accounting; graphics	Two RS232C ports; 15" CRT; eight programmable function keys; dual disk drives (320Kb or 640Kb)	$3995 to $5695
Fortune Systems Circle 345	Fortune 32:16 PS Series	16 (external), 32 (internal)	512Kb	4Kb to 16Kb	For-Pro (enhanced UNIX)	Business Basic, Fortran 77, Cobol, Pascal, C Basic, APL, Wang Basic, Sibol, C	Accounting; more than 80 vertical applications packages	3780 and X.25 communications; Interactive Terminal Emulator; teletext; Fortune-to-Fortune Copy	$7995
	Fortune 32:16 XP Series	16 (external), 32 (internal)	512Kb to 1Mb	4Kb to 16Kb	For-Pro	Same as PS Series	Fortune Word; Multiplan	Same as PS Series	$12,995
Four-Phase Systems Circle 346	Series 2000, Model 220	8 and 16	384Kb		ISOS	Basic, Cobol	Forms Design Facility II; ASQ records management system; Stylo text processing; DynaCalc electronic worksheet	Supports up to four workstations; 2780/3780, 3270 BSC, 3270 SNA/SDLC and TTY communications	N/A
	Series 2000, Model 240	8 and 16	768Kb		ISOS	Basic, Cobol	Same as Model 220	Same as Model 220, except supports up to eight workstations	N/A
	Series 2000, Model 260	16 and 32	768Kb (8/16-bit), 1Mb (32-bit)		ISOS, UNIX System V	Basic, Cobol	Same as Model 220	Same as Model 240	N/A
Fujitsu Microelectronics Circle 347	Micro 16s	16	128Kb to 1Mb; 52Kb (video); optional 1Mb (8" floppy disk) and 10Mb to 20Mb (Winchester disk)	4Kb	CP/M-86, optional MS-DOS and Concurrent CP/M-86	Cobol, Pascal, PL1, CB-86, P-Basic	SuperCalc; WordStar; SpellStar; MailMerge; GSX; DR Graph	Dual processors; dual 5¼" floppy disk drives; RGB color monitor; RS232C and Centronics interfaces; light pen interface; four channel A/D converter	$3995
General Automation Circle 348	Zebra 1500	16 and 32	256Kb	8Kb	PICK	Basic	WP; spreadsheet; graphics, data base management	Supports up to four users; bisynch communications; 16Mb to 32Mb Winchester disk; ¼" streaming tape cartridge	$15,950

Zebra 2500	16 and 32	256Kb	8Kb	PICK	Basic	WP; spreadsheet; graphics; data base management	Supports up to eight users; bisynch communications; 31Mb to 66Mb Winchester disk; ¼" streaming tape cartridge	$21,425
Zebra 3500	16 and 32	256Kb to 1Mb	8Kb	PICK	Basic	WP; spreadsheet; graphics; data base management	Supports up to 16 users; bisynch communications; 66Mb to 264Mb Winchester disk; ¼" streaming tape cartridge	$32,450
Zebra 5500	16 and 32	1Mb	8Kb	PICK	Basic	WP; spreadsheet; graphics; data base management	Supports up to 32 users; bisynch communications; 142Mb to 568Mb Winchester disk; ½" streaming tape drive	$55,300
System 9FD	8 and 16	84Kb	2Kb	CP/M, MS-DOS with 8/16 option	M-Basic, Fortran	WordStar; SuperCalc; InfoStar; dBase II	RS232C interface; high-resolution CRT; dual floppy disks (720Kb storage); bit-mapped graphics	$3995
System 9/5	8 and 16	84Kb	2Kb	CP/M, MS-DOS with 8/16 option	M-Basic, Fortran	WordStar; SuperCalc; InfoStar; dBase II	Same as System 9FD, except with 320Kb floppy disk storage and 5Mb hard disk storage	$5495
System 9/15	8 and 16	84Kb	2Kb	CP/M, MS-DOS with 8/16 option	M-Basic, Fortran	WordStar; SuperCalc; InfoStar; dBase II	Same as System 9/5, except with 15Mb hard disk storage	$6495
System 12/15	8	64Kb	1Kb	CP/M, ASP		AccPac; WordStar; SuperCalc; InfoStar; dBase II	Supports up to four users; 320Kb floppy disk storage; 15Mb hard disk storage; RS232C interface; S-100 bus	$6495 (single user)
Grid Compass	16	256Kb	16Kb	Grid-OS, MS-DOS/20	Grid Basic, Pascal-86, Fortran-86, PLM-86, iAPX-86, MS-Basic Interpreter, MS-Basic Compiler, Business Basic Compiler, MS-Cobol, MS-Pascal, MS-Fortran, MS-C	GRiDPlan spreadsheet; GRiDPlot graphics; GRiDFile data base manager; GRiDWrite text editor; GRiDPrint text formatter	GRiDTerm terminal emulator; GRiDVT100 DEC terminal emulator; GRiD3101 IBM 3101 terminal emulator	$8150
Series 80 Model 86B	8	128Kb to 640Kb		UCSD-P System, CP/M	Basic, Pascal, Fortran 77	Spreadsheet analysis; graphics; WP; data management; accounting		$2900
Series 100 HP 150	16	256Kb to 640Kb	160Kb	MS-DOS 2.0	MS-Basic	VisiCalc; MemoMaker; WordStar; graphics	HP-Touch screen; two RS232 ports; HP-IB port; dual micro floppy disk drives	$3995
Series 200 Model 16	16	320Kb to 512Kb		CP/M	Basic, Fortran, Pascal, Multi-Forth	VisiCalc; graphics; terminal emulator; WP; spreadsheet; file management		$7000 to $8000
micro-System 6/10	16	128Kb to 512Kb		GCOS 6, CP/M-86, optional MS-DOS	Basic, Cobol, Fortran, Pascal	Packages running on DPS 6 minicomputers, including office automation, data entry and transaction processing	Asynch and synch communications; LHDLC, HDLC, SDLC, PVE, RNP, BSC and SNA protocols; compatible with firm's 16- and 32-bit minicomputers; LSI technology	$3995 to $9995
micro-System 6/20	16	Up to 1Mb		GCOS 6	Basic, Cobol, Fortran, Pascal	Packages running on DPS 6; integrated packages for office automation, data entry and general purpose DP	Supports up to four users; asynch and synch communications; LHDLC, HDLC, SDLC, PVE, RNP, BSC and SNA protocols; compatible with firm's DPS 6 minicomputers	Basic system; $17,000; workstations, from $795
Personal Computer	16	640Kb	40Kb	PC-DOS, CP/M-86, UCSD-P System	Basic, Pascal, Fortran, Cobol, APL, Assembler	Thousands of industry-wide packages	Bisynch and asynch SNA; graphics; printer	From $2600
Datamaster (System 23)	8	128Kb	112Kb	Proprietary	Basic	Thousands of industry-wide packages	Bisynch and asynch communications; multiuser; hard file and file sharing; printer	From $8700
Middi-Cadet	8	Up to 512Kb		OASIS, CP/M, MP/M, MVT-Famos	Any language supported under each operating system	All packages supported under each operating system	Supports up to ten workstations; 20Mb to 60Mb hard disk storage; quad-density 5¼" floppy disk drive	$7495
High Performance Middi-Cadet	8	512Kb		OASIS, CP/M, MP/M, MVT-Famos	Any language supported under each operating system	All packages supported under each operating system	Supports up to ten users; 40Mb disk storage; quad-density 5¼" floppy disk drive	$10,995
Ensign	16	Up to 8Mb ECC memory		UNIX, OASIS-16	Any language supported under each operating system	All packages supported under each operating system	Supports up to 32 users; over 1000Mb disk storage; cartridge; nine-track tape; MC68000 CPU plus four slave CPUs for memory management and I/O	$25,000 (16-port system)
Encore 580/880	8	256Kb		CP/M, MP/M	All CP/M- and MP/M-based languages	InterPak utilities package	S-100 bus; RS232C interface; 5¼" or 8" hard and floppy disk drives	From $4995
Encore 88000	16	256Kb to 2.5Mb		XENIX	C, Pascal, Basic, Fortran	InterPak utilities package	UNIX compatible, multiuser system; 5¼" or 8" hard and floppy disk drives	$11,495

VENDOR	MODEL	WORD SIZE (in bits)	RAM CAPACITY	ROM CAPACITY	OPERATING SYSTEM	PROGRAMMING LANGUAGES	SOFTWARE PACKAGES	FEATURES (including communications protocols)	PRICE OF HARDWARE (excluding printer)
Kaypro Division of Non-Linear Systems Circle 358	Kaypro II	8	64Kb	2Kb	CP/M 2.2	Basic, Pascal, Fortran, Macro Assembler, Cobol		Dual 5¼" single-sided, double-density floppy disk drives; modem/RS232C interface; asynch protocol; parallel Centronics printer interface	$1595
	Kaypro 4	8	64Kb	2Kb	CP/M 2.2	Basic, Pascal, Fortran, Macro Assembler, Cobol		Same as Kaypro II, except with double-sided disk drives	$1995
	Kaypro 10	8	64Kb	2Kb	CP/M 2.2	Basic, Pascal, Fortran, Macro Assembler, Cobol		Single 5¼" double-sided, double-density floppy disk drive; 10Mb hard disk drive; two RS232C serial ports; parallel Centronics-type interface	N/A
Lanier Business Products Circle 357	EZ-2	8	96Kb to 256Kb (floppy), 5Mb (Winchester)		LEXS, CP/M, MS-DOS, MS-Basic	Basic, Lanier Business Basic, Lanier Macro	One-Step WP; Data Manager	3720 SNA/bisynch, 3780 and TTY/ASCII communications	$4195 per station for dual workstations
	LCWS-100 Color Work-Station		96Kb to 256Kb (floppy), 5Mb (Winchester), 24Mb + 24Mb (Lark II)		LEXS, CP/M, MS-DOS, MS-Basic	Basic, Lanier Business Basic, Lanier Macro	One-Step WP; Data Manager; color graphics	3720 SNA/bisynch communications	$9995
Logical Business Machines Circle 358	David	16	64Kb to 128Kb	4Kb	Proprietary	Natural languages	Accounts payable and receivable; general ledger	RS232C interfaces	$5400 to $6670
	Tina	16	64Kb	2Kb	Proprietary	Natural languages	Same as David	RS232C interfaces	$9170
	Adam	16	128Kb to 256Kb	4Kb	Proprietary	Natural languages	Same as David	RS232C interfaces; supports up to four users; Winchester disk storage; streaming tape drive	$19,170 to $21,000
	Goliath	16	128Kb to 256Kb	8Kb	Proprietary	Natural languages	Same as David	Same as Adam, except supports up to 20 users	$19,170 to $24,170
MAI/Basic Four Information Systems Division Circle 359	8/10	8	128Kb	16Kb	CP/M, BB/M	Business Basic	WP; general ledger; accounts payable; accounts receivable; spreadsheet	Asynch and bisynch communications; two RS232 ports; user-selectable baud rates of 50 baud to 19.2K baud	From $3995
Micro Five Circle 360	1050	16	128Kb to 512Kb	16Kb	CP/M-86, MP/M-86, SMC-Basic, Stardos, MicroCobol	Basic, Cobol, Fortran, Pascal	WP; spreadsheet; data base management; vertical applications	Supports up to five users; dual floppy disk storage; upgradeable to include 39Mb hard disk storage	$4995
	1440	16	128Kb to 512Kb	16Kb	CP/M-86, MP/M-86, SMC-Basic, Stardos, MicroCobol	Basic, Cobol, Fortran, Pascal	WP; spreadsheet; data base management; vertical applications	Supports up to five users; 12.8Mb hard disk storage, expandable to 39Mb	$7995
	1540	16	128Kb to 512Kb	16Kb	CP/M-86, MP/M-86, SMC-Basic, Stardos, MicroCobol	Basic, Cobol, Fortran, Pascal	WP; spreadsheet; data base management; vertical applications	Multi-user system; 19Mb hard disk storage, expandable to 39Mb	$8995
Modular Micro's Circle 363	ZORBA 2000	8	64Kb		CP/M	C-Basic	WordStar; MailMerge; CalcStar; SpellStar; InfoStar	Single 800Kb double-sided, quad-density disk drive; serial/parallel printer ports; RS232 communications port	$1995
	ZORBA 2000/4	8	64Kb		CP/M	C-Basic	Same as ZORBA 2000	Dual 400Kb double-sided, double-density disk drives; serial/parallel printer ports; RS232 and IEEE-488 ports	$2495
	ZORBA 2000/8	8	64Kb		CP/M	C-Basic	Same as ZORBA 2000	Same as ZORBA 2000/4, except with dual 800Kb double-sided, quad-density disk drives	$2495
	ZORBA 2000/16	16	256Kb		CP/M-86, Concurrent CP/M-86, MS-DOS	C-Basic	Same as ZORBA 2000	Same as ZORBA 2000/8	$2995
Mohawk Data Sciences Circle 361	21/10	8	256Kb		OS2, CP/M	Basic, Cobol, Mobol	WP; Plan 21; Find 21; electronic mail	2780, 3780, 3270, SNA, X.25 and 3776 communications	Approx. $6000
	Series 21	8	512Kb		OS2, CP/M	Basic, Cobol, Mobol	WP; Plan 21; Find 21; electronic mail	2780, 3780, 3270, SNA, X.25, 3776 and SDLC communications	Approx. $7900
Molecular Computer Circle 362	Super Micro 8	8 or 16	64Kb to 1Mb	2Mb	N/Star (proprietary), CP/M		MenuMaster		$5995
	Super Micro 32X	8 or 16	64Kb to 5Mb	4Mb to 8Mb	N/Star, CP/M		MenuMaster		$18,995
Monroe Systems For Business Circle 364	EC8800	8	128Kb	128Kb	Monroe multitasking, CP/M	Basic, Pascal, Pilot	Education	TTY asynch communications	$2695
	OC8820	8	128Kb	128Kb	Monroe multitasking, CP/M	Basic, Pascal	Accounting; banking; SuperCalc; medical/dental; SuperWord	IBM 2780/3780 and 3270 bisynch, TTY asynch and SDLC communications	$3895

VENDOR	MODEL	WORD SIZE (in bits)	RAM CAPACITY	ROM CAPACITY	OPERATING SYSTEM	PROGRAMMING LANGUAGES	SOFTWARE PACKAGES	FEATURES (Processor, Communications, Peripherals, Memory)	PRICE (HARDWARE only)
Morrow Circle 368	Micro Decision MD2		64Kb	400Kb (dual single-sided 5¼" floppy disks)	CP/M	MS-Basic 80, BaZic	WordStar; Correct-It; LogiCalc; Personal Pearl	BIOS (reads and writes multiple formats)	$1599
	Micro Decision MD3		64Kb	768Kb (dual double-sided 5¼" floppy disks)	CP/M	MS-Basic 80, BaZic	WordStar; Correct-It; LogiCalc; Personal Pearl; Quest bookkeeping	BIOS	$1899
	Morro-Writer		64Kb	400Kb	CP/M	MS-Basic 80, BaZic	New Word; Correct-It; Index Program; List Manager		$2495 (printer standard)
	Decision 1, Model D120		64Kb	Single double-sided floppy disk, 10Mb hard disk	CP/M	MS-Basic 80, BaZic	WordStar; Correct-It; LogiCalc; Personal Pearl	BIOS: single-user system	$4995
	Decision 1, Model D210		256Kb	Single double-sided floppy disk, 16Mb hard disk	Micronix	MS-Basic 80, BaZic	WordStar; Correct-It; LogiCalc; Personal Pearl	Supports up to three users	$5995
Multi-Tech Systems Circle 366	MT500	8	64Kb	2Kb	CP/M	Basic, Pascal, Fortran, Cobol	WP; MRP; accounting	Floppy and hard disk storage; S-100 bus; asynch and synch communications	$4795 to $8995
NCR Circle 367	WS110	16	256Kb to 512Kb	2Kb	CTOS, CP/M-86, MS-DOS	Basic, Cobol, Fortran, Pascal	WP; records processing; auto letter; Multiplan; MultiList	Asynch TTY, 2780/3780 and 3270 bisynch, and 3270 SNA communications; IRS-422 port; cluster workstation	From $2650
	WS121	16	256Kb to 512Kb	2Kb	CTOS, CP/M-86, MS-DOS	Basic, Cobol, Fortran, Pascal	WP; records processing; auto letter; Multiplan; MultiList	Asynch TTY, 2780/3780 and 3270 bisynch, and 3270 SNA communications; 630Kb floppy disk; two RS232 ports; RS422 port	From $4895
	WS140/ 141	16	256Kb to 512Kb	2Kb	CTOS, CP/M-86, MS-DOS	Basic, Cobol, Fortran, Pascal	WP; records processing; auto letter; Multiplan; MultiList	Asynch TTY, 2780/3780 and 3270 bisynch, and 3270 SNA communications; can support up to two additional workstations; 5Mb Winchester disk; 630Kb 5¼" floppy disk; two RS232 ports; RS422 port	From $6395
	WS150/ 151	16	256Kb to 512Kb	2Kb	CTOS, CP/M-86, MS-DOS	Basic, Cobol, Fortran, Pascal	WP; records processing; auto letter; Multiplan; MultiList	Asynch TTY, 2780/3780 and 3270 bisynch, and 3270 SNA communications; supports up to four workstations; 16Mb Winchester disk; 630Kb 5¼" floppy disk; two RS232 ports; RS422 port	From $9650
	WS210/ 211	16	256Kb to 1Mb	2Kb	CTOS, CP/M-86, MS-DOS	Basic, Cobol, Fortran, Pascal	WP; records processing; auto letter; Multiplan; MultiList	Asynch TTY, 2780/3780 and 3270 bisynch, and 3270 SNA communications; supports up to 16 workstations; expandable to 120Mb disk storage; two RS232 ports; RS422 port	From $10,100
NEC Information Systems Circle 369	APC™ Advanced Personal Computer	16	128Kb to 640Kb	8Kb	CP/M-86, MS-DOS, UCSD-P System	Basic, Cobol, Pascal, Fortran	Accounting; WP; graphics; spreadsheet; data base management; communications	Asynch-86, bisynch-86/ 3270 and /3780, SNA/ SDLC, and COAXXYS-86/ 3270 direct connect communications	$2748
Nixdorf Computer Circle 370	8810	8	128Kb to 192Kb		CP/M-Plus, Codis	Basic, Cobol, Pascal, PL1, Fortran		TTY, 3270 and 2780/ 3780 communications; Nixdorf data terminal VT100	$4900
Norsk Data Circle 371	503	8	128Kb to 640Kb	4Kb	4.1 Omnitask	Cobol, TAL-2000	Omniword WP; Omnimail electronic mail	Multitasking; "Suspend" (allows one terminal to run multiple jobs simultaneously); BSC, asynch and SDLC communications; Omnilink local area network	$4945
	565	8	256Kb to 512Kb	2Kb	4.1 Omnitask	Cobol, TAL-2000	Omniword; Omnimail	Same as 503, plus capability to run CP/M with a special board	$14,200
	585	8	256Kb to 512Kb	2Kb	4.1 Omnitask	Cobol, TAL-2000	Omniword; Omnimail	Same as 565	$19,500
North Star Computers Circle 372	Horizon	8 and 16	64Kb to 2Mb	1Kb	DOS, CP/M, PSS/C, Turbo-DOS, TBS-OS	Basic, Fortran, Cobol, Pascal, C	NorthWord; Infomanager II; general ledger with financial reporting; accounts payable and receivable; payroll; inventory control and analysis; order entry and invoicing; SpellStar; MailMerge; enhanced WordStar, Microplan, dBase II and NorthSpell	S-100 bus; serial and parallel communications ports; large storage capacity; optional 5Mb or 15Mb internal disk storage	From $2999

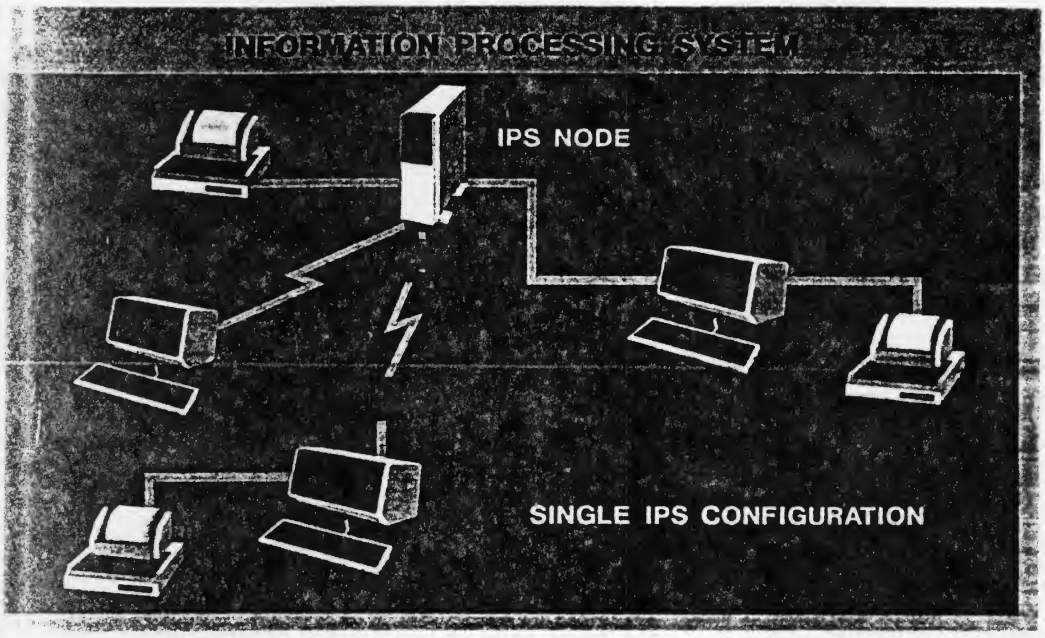
VENDOR	MODEL	WORD SIZE (in bits)	RAM CAPACITY	ROM CAPACITY	OPERATING SYSTEM	PROGRAMMING LANGUAGES	SOFTWARE PACKAGES	FEATURES (including communications protocols)	PRICE OF HARDWARE (excluding printer)
North Star (purchased)	Advantage	8 and 16	84Kb to 340Kb	4Kb	Graphics-DOS, Graphics-CP/M, Graphics MS-DOS, TBS-OS, NorthNet local area network	Same as Horizon, plus Graphics Basic, Graphics Libraries	Same as Horizon, plus NorthWord II; NorthPlan; ImageMaker; BusiGraph II	Portable; local area networking; high-resolution graphics; interactive presentation; optional 5Mb or 15Mb internal disk storage	From $2999
Olympia Circle 372	People	16	128Kb	4Kb Boot Strap	CP/M-86	C-Basic, Pascal, Cobol	WordStar; SuperCalc; dBase II; graphics; accounting; financial	2780/3780, 3270, X.21 and X.25 communications; dual disk drives (1.3Mb); 12 programmable function keys	$3595
Onyx Systems Circle 373	C5001A	8	192Kb		CP/M, MP/M, OASIS	Basic, Cobol		5¼" hard disk storage	$5990
	2000	16	64Kb to 256Kb		Business Basic, MP/M-86	Basic, Cobol		5¼" hard disk storage; choice of floppy or tape backup	$6750
	Sundance II	8	192Kb		CP/M, MP/M, OASIS	Basic, Cobol		5¼" hard disk storage; 80- or 132-column CRT	$7590
	C5002A	16	256Kb to 512Kb		UNIX System III	Basic, Cobol, Fortran, C, Pascal		5¼" hard disk storage; supports OmniNet local area network	$11,990
	C8002A	16	256Kb to 512Kb		UNIX System III	Basic, Cobol, Fortran, C, Pascal		8" hard disk storage; supports OmniNet	$13,990
QSM Computer Corp. Circle 374	Zeus 3	8 and 16	2.1Mb		MUSE	Cobol, Pascal, Fortran, PL1, Basic, Forth	5000 CP/M and MP/M programs, including WP; data base; spreadsheet	Supports two to 32 users, each with two ports and 64Kb RAM; 12Mb to 50Mb Winchester disk storage	$14,000 (typical eight-user configuration)
Otrona Advanced Systems Circle 375	Attache "S"	8	64Kb	4Kb	CP/M-80	Optional Basic-80, Pascal, Fortran, Cobol	CP/M: WordStar-Plus; Multiplan; Valet; Charton; Disk Manager	Portable; single 360Kb disk drive; graphics; switchable power supply	$2695
	Attache	8	64Kb	4Kb	CP/M-80	Optional Basic-80, Pascal, Fortran, Cobol	CP/M; WordStar-Plus; Multiplan; Valet; Charton; Disk Manager	Portable; dual 360Kb disk drives; graphics; switchable power supply	$2995
	Attache 8:16 "S"	8 or 16	64Kb (8-bit), 256Kb (16-bit)	4Kb	CP/M-80, MS-DOS	Optional Basic-80, Pascal, Fortran, Cobol	Valet	Portable; single 320Kb disk drive; graphics; IBM PC-compatible	$3495
	Attache 8:16	8 or 16	64Kb (8-bit), 256Kb (16-bit)	4Kb	CP/M-80, MS-DOS	Optional Basic-80, Pascal, Fortran, Cobol	Valet	Portable; dual 320Kb disk drives; graphics	$3795
Perkin-Elmer Circle 376	7500	16 and 32	640Kb (color), 416Kb (monochrome)	32Kb	IDRIS	Basic, Fortran, C	PecoWriter text processing	Two RS232 ports, dual 5¼" floppy disk drives; eight programmable function keys; numeric keypad and graphic control keys; monochrome or color display	$8400
Perlos Computer Corp. Circle 377	3200 Series	16	512Kb to 1Mb		Proprietary	Basic, CP/M, RM Cobol	Approximately 25 applications packages including WP; accounting; payroll	Supports up to 32 terminals and 33 line printers; up to eight Winchester disk drives (70Mb each); 2780/3780 bisynch and 3270 SNA communications; RS232 interface; monochrome or color terminals	From under $5000
Philips Information Systems Circle 408	Information Processing System	32	256Kb to 1Mb		UNIX System III	C, Cobol, Fortran, Pascal	Diary and Meetings Management; Meeting Scheduling; Teletex; office filing system; electronic mail system	Can support four to 30 workstations; SNA and X.25 communications; multilevel security	From $50,000
Pixel Computer Circle 378	Pixel 80	16 and 32	.5Mb to 6Mb		UNIX	Basic, Pascal, Fortran, Cobol, APL, Assembler	WP; spreadsheet; data base; business applications packages	High-resolution graphics; communications; 38Mb to 420Mb hard disk storage	From $18,550
Plessey Circle 379	6100	16	64Kb		RT11, TSX-plus	Basic, Fortran, Macro, Cobol, Dibol, Pascal		LSI/1102 CPU; five EIA ports; 10Mb Winchester disk with floppy or streaming cartridge tape backup	$5295 to $8395
	6200	16	256Kb to 768Kb		RT11, TSX-plus, RSX11M (M+), M11, Unity, RSTS/E	Basic, Fortran, Macro, Cobol, Dibol		LSI/1123 CPU; five EIA ports; 10Mb or 20Mb Winchester disk with floppy or streaming cartridge tape backup	$7660 to $13,565
	6400	16	256Kb		RT11, TSX-plus, RSX11M (M+), M11, Unity, RSTS/E	Basic, Fortran, Macro, Cobol, Dibol		LSI/1123 CPU; five EIA ports; 28Mb Winchester disk with floppy or streaming cartridge tape backup	$15,220 to $16,335
	6600	16	256Kb		RT11, TSX-plus, RSX11M (M+), M11, Unity, RSTS/E	Basic, Fortran, Macro, Cobol, Dibol		LSI/1123 CPU; six EIA ports; 80Mb Winchester disk with floppy or streaming cartridge tape backup	$17,250 to $18,975
	6700	16	512Kb to 4Mb		RT11, TSX-plus, RSX11M (M+), M11, Unity, RSTS/E	Basic, Fortran, Macro, Cobol, Dibol		Same as 6600	$19,250 to $20,975

P/25	16	2Mb	64Kb	UNIX System III	Cobol, C, C-Basic 16, Pascal, Fortran	All third-party packages written for UNIX	Supports Ethernet, standard synch and asynch communications to 19.2Kbps, X.25, BSC, SDLC, UUCP and 2780/3780 emulation	From $11,250
P/35	16 and 32	2Mb	64Kb	UNIX System III	Cobol, C, C-Basic 16, Pascal	All third-party packages written for UNIX	Same as P/25	From $13,500
P/40	16	4Mb	64Kb	UNIX System III	Cobol, C, C-Basic 16, Pascal, Fortran	All third-party packages written for UNIX	Same as P/25	$37,950 (typical eight-user system)
P/60	16 and 32	4Mb	64Kb	UNIX System III	Cobol, C, C-Basic 16, Pascal	All third-party packages written for UNIX	Same as P/25	$42,950 (typical configuration)
PolyEtte	16	256Kb		V-MOS	Fortran, Cobol, Basic, Iris Basic, Pascal plus Blis Cobol Liberator	All packages that run under the programming languages; Data General Point-4 applications	Supports up to 16 users and seven processors; Nova-compatible; can network up to 256 users	From $15,000
Poly-16	16	4Mb MOS memory		V-MOS	Fortran, Cobol, Basic, Iris Basic, Pascal plus Blis Cobol Liberator	Same as PolyEtte	Supports up to 100 users; Nova-compatible; 1.2Gb mass storage; software upward and downward compatible	From $29,000
16/10	16	128Kb to 1Mb	16Kb	MS-DOS 2.0	MS-Basic	Execu-Aid; Execu-Bus; Execu-File; Execu-Writer; Execu-Model; Execu-Word; MS-DOS 2.0-compatible packages	Single 800Kb floppy disk; two asynch RS232 ports; detachable keyboard; optional Pronto Magician™ graphics board and memory upgrades	$2995
16/20	16	128Kb to 1Mb	16Kb	MS-DOS 2.0	MS-Basic	Same as 16/10	Same as 16/10, except with dual 800Kb floppy disks (1.6Mb total disk storage)	$3750
16/110	16	128Kb to 1Mb	16Kb	MS-DOS 2.0	MS-Basic	Same as 16/10	Same as 16/10, plus 5.3Mb removable hard disk (6.1Mb total disk storage)	$4995
16/200	16	128Kb to 1Mb	16Kb	MS-DOS 2.0	MS-Basic	Same as 16/10	Same as 16/10, except with dual 5.3Mb removable hard disks (10.6Mb total disk storage)	$5995
QDP-300	8	128Kb to 512Kb	2Kb to 16Kb	CP/M, MP/M	C-Basic	CP/M-based packages	Dual 8" double-sided, double-density diskettes; Slimline system	$3995
QDP-100	8	128Kb to 512Kb	2Kb to 16Kb	CP/M, MP/M	C-Basic	CP/M-based packages	Dual 8" double-sided, double-density diskettes; six-slot S-100 motherboard	$4695
500	8	64Kb	2Kb to 14Kb	CP/M	Basic, Cobol, Fortran, Pascal	WP; leasing; general accounting; newspaper distribution; educational; POS	RS232 interface; Centronics compatible; TTY; IBM 3740, 3780 and 3270 communications	$1995
520	8	64Kb	2Kb to 14Kb	CP/M	Same as 500	Same as 500	Same as 500	$2395
540	8	64Kb to 208Kb	2Kb to 14Kb	CP/M, MP/M	Same as 500	Same as 500	Same as 500	$2995
900	8	64Kb to 208Kb	2Kb to 14Kb	CP/M, MP/M	Same as 500	Same as 500	Same as 500	$3795
550	8	64Kb to 208Kb	2Kb to 14Kb	CP/M, MP/M	Same as 500	Same as 500	Same as 500	$4595
560	8	64Kb to 208Kb	2Kb to 14Kb	CP/M, MP/M	Same as 500	Same as 500	Same as 500	$4995
570	8	64Kb to 208Kb	2Kb to 14Kb	CP/M, MP/M	Same as 500	Same as 500	Same as 500	$6295
910	8	208Kb	2Kb to 14Kb	CP/M, MP/M	Same as 500	Same as 500	Same as 500	$8495
936	8	208Kb	2Kb to 14Kb	CP/M, MP/M	Same as 500	Same as 500	Same as 500	$9995
900/33	8	64Kb to 208Kb	2Kb to 14Kb	CP/M, MP/M	Same as 500	Same as 500	Same as 500	$10,995
Avatar TC1/TC10	8	64Kb	4Kb	CP/M	Basic	WordStar; CalcStar	Two RS232C ports; single or dual disk drives; 5Mb, 10Mb or 20Mb disk storage	$1795 to $5895
Avatar TC100/ TC110	16	128Kb to 256Kb	8Kb	CP/M, MS-DOS	Basic	WordStar; CalcStar	Same as Avatar TC1/TC10, except with three RS232C ports	$2195 to $6295
Avatar TC3278	8 and 16	64Kb to 256Kb	4Kb to 8Kb	CP/M, MS-DOS	Basic	WordStar; CalcStar	IBM coax and RS232C ports; single or dual disk drives; 5Mb, 10Mb or 20Mb disk storage; designed for use with IBM 3278 terminals	$2945 to $7295
Color Computer	8	32Kb	32Kb	MS-Basic	Basic, Extended-Basic, Disk-Basic, Logo, Pilot, Assembly	Over 100 packages, including WP; VisiCalc; Multiplan; data base management; accounting	Serial port; two joystick ports; cassette port; program pack slot; 53-key keyboard; RF modulator for TV	$119 to $399.95

Model 100	8	32Kb	64Kb	Proprietary	Basic	Basic; Text; Telecommunications; Address; Schedule	RS232 interface; direct-connect; auto-dial modem; parallel printer port; 1500 baud cassette port	$799
Model 4	8	128Kb	14Kb	TRSDOS-6	Basic, Cobol, Pascal, Fortran	Over 100 packages, including WP; VisiCalc; Multiplan; data base management; accounting	RS232 interface; built-in printer, monitor and keyboard; dual 184Kb disk drives	$1999
Model 12	8	64Kb		TRSDOS	Basic, Cobol, Fortran	Over 30 packages, including WP; VisiCalc; Multiplan; data base management; accounting		$3199
Model 16B	16	768Kb		TRS-XENIX	Basic, Cobol, C	Over 25 packages, including WP; VisiCalc; Multiplan; data base management; accounting		$4999
MBC 550	16	128Kb	4Kb	MS-DOS, optional CP/M-86	Basic	WP; spreadsheet	Centronics port; IBM PC-compatible; optional 160Kb, 320Kb and 640Kb disk drives	$995
MBC 1100	8	64Kb	4Kb	CP/M	Basic	Micropro	Serial RS232C Centronics port; ergonomic keyboard; tilt base; optional 327Kb disk drive	$1995
MBC 1200	8	64Kb	4Kb	CP/M	Basic	Micropro	Serial RS232C Centronics port; ergonomic keyboard; high-resolution graphics; optional 640Kb disk drive	$2495
MBC 4000	16	128Kb	4Kb	CP/M-86, optional MS-DOS	Basic	Micropro	Serial RS232C Centronics port; ergonomic keyboard; optional 640Kb disk drive	$3295
PC-1250	8	2.2Kb	24Kb	C-MOS	Basic	Over 50 general purpose packages	Student computer kit; battery operation; user function keys	$110
PC-1500	8	3.5Kb	16Kb	C-MOS	Basic	Scientific; engineering	Optional RAM expansion, four-color printer, battery operation and RS232 interface	$220
PC-5000	16	128Kb	192Kb	MS-DOS	GW-Basic	WP; communications; spreadsheet; executive planner	RS232 interface; dual 5¼" floppy disk drives; battery operation	N/A
SMC-70	8 and 16	64Kb	32Kb	CP/M	SonyPilot, SonyBasic	WP; communications; accounting; data base management; decision support	Thirteen resident I/O ports, including RS232C and Centronics-type parallel printer port; video capability; 3½" micro floppy disk	$995
M68	8 and 16	256Kb to 1Mb	4Kb	CP/M, MS-DOS, UNIX, UCSD-P System	Basic, Assembler, Fortran, RM/Cobol, Pascal	PIPS III spreadsheet/data base management/graphics system; CP/M-based business and scientific packages	Dual processor; dual 5¼" floppy disk drives (1.2Mb formated capacity each); two RS232C serial interface ports; Centronics-compatible parallel printer port; IEEE-488 I/O port; high-resolution graphics capability	Under $5000
Desktop	16	128Kb to 896Kb	16Kb	MS-DOS, S-DOS, Concurrent CP/M-86 with GSX Graphics	Basic, Cobol, Fortran, Pascal	Multiplan; WordStar; SpellStar; MailMerge; WordPerfect with spelling and sort; Open Systems Accounting; dBase II	Single or dual 5¼" floppy disk drives; optional 10Mb hard disk drive; asynch, 3275 and 3271 bisynch, 3276 SNA/SDLC and 3780 bisynch RJE communications	$2945 (single disk drive); $3475 (dual drives)
Micronetwork	16	128Kb to 896Kb	16Kb	MS-DOS, S-DOS, Concurrent CP/M-86 with GSX Graphics	Basic, Cobol, Fortran, Pascal	Same as Desktop	Same as Desktop, plus network for two to five workstations; send/receive files; chat; mail; each master supports three printers	Same as Desktop, plus $1200 for each master; $500 each workstation
330	16	96Kb	272Kb	MS-DOS, CP/M-86	MACR-86, Basic, Utilities, ASM, Multiplan	WP; data base; financial planning; accounting; graphics	Modular; bundled software; RS232C and IEEE-488 interface ports; ASCOM communications	$1795 to $6475
830	8	128Kb	256Kb	CP/M	Pascal-M, Basic-80, Fortran-80, Cobol-80, PL1-80	WP; data base; financial planning; accounting; graphics	CPU; CRT; printer; keyboard; disk drives; bundled software; *RS232C*, IEEE-488 and Centronics interface ports; ASCOM communications	$3995 (printer *standard*)
Tab System 830	8	64Kb		CP/M 2.2	English prompts	Any CP/M-compatible package	Asynch, IBM 3270 and 3780 bisynch, SNA/SDLC and IBM HASP communications	From $5495

VENDOR	MODEL	WORD SIZE (in bits)	RAM CAPACITY	ROM CAPACITY	OPERATING SYSTEM	PROGRAMMING LANGUAGES	SOFTWARE PACKAGES	FEATURES	PRICE
Tab Products (continued)	Tab System 1630	16	128Kb to 768Kb		CP/M-86	English prompts	Any CP/M-compatible package	Asynch, IBM 3270 and 3780 bisynch, SNA/SDLC and IBM HASP communications	From $5995
	Tab System 1650	16	128Kb to 768Kb		MP/M-86	English prompts	Any CP/M-compatible package	Asynch, IBM 3270 and 3780 bisynch, SNA/SDLC and IBM HASP communications	N/A
Texas Instruments Circle 394	Professional Computer	16	64Kb to 256Kb	8Kb	MS-DOS, CP/M-86, P-System	Basic, Pascal, Cobol, Fortran, C, 8088 Assembler	Lotus 1-2-3; EasyWriter; dBase II; BPI accounting packages	Asynch and synch communications, including TTY, 3780/3270 software; single or dual 320Kb 5¼" floppy disks; 10Mb Winchester disk; 300 or 1200 baud internal modem	$2195
Timex-Sinclair Circle 395	TS 1000	8	2Kb	8Kb		Sinclair Extended Basic	Business; education; home	Printer; modem; RAM pack	$49.95
	TS 1500	8	8Kb	16Kb		Sinclair Extended Basic	Business; education; home	Printer; modem; RAM pack	$79.95
	TS 2068	8	48Kb	24Kb		Sinclair Extended Basic	Business; education; home	Solid-state cartridge software; color	$199.95
Toshiba America Circle 396	T100 Portable Personal Computer	8	64Kb	32Kb	Basic	T-Basic ROM (Toshiba Basic)		Portable; LCD; RAM 16; modem; RS232C interface	$1590
	T100 Personal Computer	8	64Kb	32Kb	T-Basic, CP/M	T-Basic, C-Basic II, T-Disk Basic		CPU/keyboard; green display; dual 5¼" floppy disk drives	$1995
	T300 Personal/Business Computer	16	192Kb	4Kb	T-Basic 16, MS-DOS 2.0, optional CP/M-86	T-Basic 16, optional C-Basic 16		CPU/keyboard; green display; 640Kb floppy disk drive	$2495
Vector Graphic Circle 397	4/00	8 and 16	128Kb (standard), 256Kb (optional)	8Kb	CP/M, CP/M-86, optional Concurrent CP/M and MS-DOS	M-Basic, Cobol, Fortran, Pascal, C-Basic 86	Memorite III WP; ExecuPlan II spreadsheet; GSX-86 graphics	Network terminal on the LINC local area network; accesses disk storage devices of other Vector 4 systems; shared operating systems, software and data files	$2795
	4/10	8 and 16	Same as 4/00	8Kb	Same as 4/00	Same as 4/00	Same as 4/00	630Kb floppy disk storage	$3295
	4/20	8 and 16	Same as 4/00	8Kb	Same as 4/00	Same as 4/00	Same as 4/00	1.2Mb floppy disk storage	$3995
	4/30	8 and 16	Same as 4/00	8Kb	Same as 4/00	Same as 4/00	Same as 4/00	630Kb floppy disk storage; 5Mb hard disk storage	$4994
	4/40	8 and 16	Same as 4/00	8Kb	Same as 4/00	Same as 4/00	Same as 4/00	630Kb floppy disk storage; 10Mb hard disk storage	$5995
	4/60	8 and 16	Same as 4/00	8Kb	CP/M-86	Same as 4/00	Same as 4/00	630Kb floppy disk storage; 42Mb hard disk storage	$9995
Victory Computer Systems Circle 398	Factor	16	256Kb to 4.25Mb	32Kb	Multi-user UNIX (EDP), UNIX+VRTX (industrial), optional UNIX+CP/M-80	Cobol (RM), Basic (SMC), Pascal (SVS), Fortran (SVS), ADA, C	WP; business applications; spreadsheet (about 100 packages available)	Supports eight to 24 users; option to run UNIX and CP/M programs concurrently	From $13,950
	Spirit	16	4.25Mb	32Kb	Multi-user Concurrent CP/M-86, optional CP/M-80	Cobol, Basic, Pascal, Fortran, C, PL/M	WP; business applications; spreadsheet (about 2000 packages available)	Optional Ethernet communication processor at 10Mbps; supports 3780, 2780 and 3270 emulation protocols	$13,950 to $26,000
Wang Laboratories Circle 407	Professional Computer	16	128Kb to 640Kb		MS-DOS, optional CP/M-80 and P-System	Basic, Interpretive Basic, Cobol, Fortran, Pascal	WP; Multiplan; graphics; data base; Lotus 1-2-3; VisiCalc; TK! Solver	Single or dual floppy disks; remote WangNet; terminal emulation; voice attachment; asynch, TTY, 928, 2780/3780, 3270 and WPS communications; local interconnect option	From $2595
	OIS 40	8	64Kb		Proprietary	Basic	CP/M; spelling verifier; Multiplan; paragraph retrieval; list processing	2780/3780, 3271E, TTE, WPS and SNA communications	$6200
Wilson Jones Circle 399	500-M82	8	64Kb to 512Kb		CP/M, Turbodos	Basic, dBase	MicroPro; WordStar; MailMerge; SpellStar; CalcStar; InfoStar; accounting packages; inventory control; Ashton-Tate dBase II; financial planner	Z80A processor; dual 5¼" floppy disk drives (409Kb storage each); expandable to four floppy drives or a 6Mb, 12Mb or 24Mb hard disk drive; upgradeable to multi-user system	$3300 to $3800
	500-D82	8	64Kb to 512Kb		CP/M, Turbodos	Basic, dBase	Same as 500-M82	Same as 500-M82, plus detachable keyboard; alphanumeric keyboard	$3700 to $4200
	800-M82	8	64Kb to 512Kb		CP/M, Turbodos	Basic, dBase	Same as 500-M82	Z80A processor; dual 8" floppy disk drives (1.2Mb storage each); expandable to four floppy drives or a 24Mb, 40Mb or 85Mb hard disk drive	$5000 to $5500

506-M82	8	64Kb to 512Kb		CP/M, Turbodos	Basic, dBase	Same as 500-M82	Z80A processor; dual 5¼" floppy disk drives (409Kb storage each); 6Mb hard disk drive; expandable to four floppy disk drives or a 12Mb or 24Mb hard disk drive; upgradeable to multi-user system	$5300 to $5800
506-D82	8	64Kb to 512Kb	2Kb	CP/M, Turbodos	Basic, dBase	Same as 500-M82	Same as 506-M82, without serial/parallel interfaces	$5700 to $6200
512-M82	8	64Kb to 512Kb		CP/M, Turbodos	Basic, dBase	Same as 500-M82	Z80A processor; dual 5¼" floppy disk drives (409Kb storage each); 12Mb hard disk drive; expandable to four floppy disk drives or a 24Mb hard disk drive; upgradeable to multi-user system	$5700 to $6200
512-D82	8	64Kb to 512Kb		CP/M, Turbodos	Basic, dBase	Same as 500-M82	Same as 512-M82, plus serial/parallel interfaces; detachable keyboard; special function keys	$6100 to $6600
524-M82	8	64Kb to 512Kb		CP/M, Turbodos	Basic, dBase	Same as 500-M82	Z80A processor; dual 5¼" floppy disk drives (409Kb storage each); 24Mb hard disk drive; expandable to four floppy disk drives; upgradeable to multi-user system	$6200 to $6700
524-D82	8	64Kb to 512Kb		CP/M, Turbodos	Basic, dBase	Same as 500-M82	Same as 524-M82, plus detachable keyboard; alphanumeric keyboard with ten-key numeric pad; special function keys; tape backup; buffered address and control lines to S-100 bus	$6700 to $7200
821-M82	8	64Kb to 512Kb		CP/M, Turbodos	Basic, dBase	Same as 500-M82	Z80A processor; dual 8" floppy disk drives (1.2Mb storage each); 24Mb hard disk drive; expandable to four floppy disk drives or a 40Mb drive; 85Mb hard disk drive; upgradeable to multi-user system	$8000 to $8500
840-M82	8	64Kb to 512Kb		CP/M, Turbodos	Basic, dBase	Same as 500-M82	Same as 821-M82, except with 40Mb hard disk drive, expandable to 85Mb	$10,500 to $11,000
885-M82	8	64Kb to 512Kb		CP/M, Turbodos	Basic, dBase	Same as 500-M82	Same as 821-M82, except with 85Mb hard disk drive	$12,200 to $12,700
Desktop PC	16	128Kb to 512Kb		MS-DOS	GW-Basic	PC-Tutor; Multi-Mate WP; dBase II; Context MBA	IBM PC-compatible; RS232C serial port	N/A
Portable PC	16	128Kb to 512Kb		MS-DOS	GW-Basic	Same as Desktop	Same as Desktop	N/A
820-II	8	64Kb	4Kb	CP/M	Basic-80, C-Basic, ATI (for CP/M)	WordStar 3.3; Select; dBase II; the Boss; Super-Calc; Analyst	Upgradeable to 16/8	$1795
16/8	8 and 16	64Kb to 128Kb	4Kb and 8Kb	CP/M-80, CP/M-86, MS-DOS	Basic, MS-DOS, Fortran, Cobol	WordStar 3.3; Select; dBase II	CP/M conversion; advanced error recovery procedures; flexible file characteristics; user interface files; line text editor	$2245
Z-100	8 and 16	128Kb to 768Kb	8Kb to 32Kb	CP/M, Z-DOS MS-DOS	Basic-80, Z-Basic, Bascom-86, MS-Basic, Fortran, Cobol, Pascal	WP; business applications; language/utilities; Lotus 1-2-3; PeachText 5000; Z-Chart business graphics	Two serial ports; one parallel port; S-100 bus expansion; eight-color capability; single or dual 5¼" floppy disk drives (320Kb)	From $2894
2020	16	256Kb to 1Mb	16Kb	Xenix	C, Basic, SMC-Basic, Cobol Level II	WP; accounts payable and receivable; payroll; general ledger; inventory control	Multi-user; 10Mb, 20Mb or 40Mb Winchester disk storage; two serial ports; variety of printers	From $8550
System 8000 Model 11	16	Up to 1Mb		UNIX	PLZ/ASM, C, Fortran 77, Pascal, RM/Cobol, SMC-Basic, MIMIX (Z-80 CP/M emulator)	Third-party packages	Can support up to eight users; cartridge tape drive	From $14,950
Model 21	16	Up to 4Mb		UNIX	PLZ/ASM, C, Fortran 77, Pascal, RM/Cobol, SMC-Basic, MIMIX	Third-party packages	Can support up to 24 users; cartridge tape drive; 80Mb SMD disk drive	From $22,950
Model 31	16	Up to 4Mb		UNIX	PLZ/ASM, C, Fortran 77, Pascal, RM/Cobol, SMC-Basic, MIMIX	Third-party packages	Can support up to 24 users; cartridge tape drive; optional nine-track mag tape drive	From $31,950



Information processor features 32-bit supermicrocomputer

Philips Information Systems has introduced the Information Processing System (IPS), which includes a 32-bit supermicrocomputer that functions as the central processor for the firm's new universal workstations. In addition, the supermicro serves as a gateway processor, connecting the company's local area network (also recently announced) to telephone systems.

According to John Clark, president of Philips, "The IPS, a major component of our office automation strategy, lets users tailor powerful, decentralized processing systems for the greatest cost efficiency. This system brings the power and capabilities of a supermicro to the individual operator."

The IPS is designed to provide central processing for a department or small business by adding data base management and decision support capabilities to an office system. Features of the IPS include a Diary and Meetings Management System, a Meeting Scheduling facility, Electronic Mail, Telex capability and an Office Filing System.

The Diary and Meetings Management System provides a rolling diary of the current month and up to a year forward. It allows the user to maintain and view a personal diary and to add, delete or move entries while viewing the diary on the screen.

The Meeting Scheduling facility is a subsystem that automatically schedules meetings between diary-holders on workstations connected through an IPS node or different nodes. Those who do not have access to the diary system are scheduled semiautomatically by the user.

The Electronic Mail System also allows for intra- and internode operation. The system can handle both short and simple messages or large documents within a data base management system. Users may classify the transmission of their documents as "urgent," "normal" or "overnight."

The Telex facility enables any workstation connected to IPS to send and receive telexes through public information networks.

The Office Filing System creates an electronic filing cabinet with "drawers" and "folders," along with document-reference information based on a search-and-retrieval system for both personal and departmental levels.

"What we're doing is combining word processing, data processing and personal computing with advanced communications features. Users do not have to switch systems or waste time moving from one workstation to another to perform different tasks," said Clark.

According to the firm, two important considerations in the design of IPS are security and compatibility. Because of its shared-resource filing capabilities, the system is equipped with five levels of security. These are user identification, password sign-on, designation of individual workstations to execute certain tasks, and two levels of workstation identification for user-specified access to certain files and mail items.

Compatibility is achieved by "following network trends as standards are put in place," according to Clark. This allows the supermicro to communicate with data and word processing workstations as well as with mainframes and other systems that use industry standards.

Available in two versions, the IPS supports four to eight workstations in its low-end version and from eight to thirty workstations in its high-end version. It handles all the administrative functions for data base management, decision support and communications.

For more information, call Sherry Hoskins, (214) 386-5580, or circle 410 on the information-exchange card.

SYSTEM SPECS

The Information Processing System, which uses the UNIX™ System III operating system, has up to 4Mb of main memory (256Kb to 1Mb RAM) and up to 500Mb of disk storage. It connects local workstations through short-haul modems and via CATV baseband cable to the Philips local area network. The network may be upgraded to broadband.

As a gateway processor, the IPS allows interconnections through public or private networks to remote-location systems using advanced communications protocols such as SNA/SDLC and X.25. As a central processing unit, it provides enhanced end-user programming in C, Cobol, Fortran and Pascal languages.

Price: $50,000 to $300,000, depending on the configuration and functions required.

Section 4

Systems Software

Terminology

Operating System - A program to handle all the housekeeping functions required by application programs.

Single User System - A "personal" Personal Computer.

Multiprocessing - An operating system that carries on multiple tasks at the same time; also called multitasking.

Multiuser - A multiprocessing system that works with several users simultaneously. It is also called a Time Shared or Shared Logic System.

Concurrent Operations - A system capable of multiple processing for a single user.

Utility Programs - Housekeeping programs to augment the operating system with file handling and conversion functions.

Compiler - A program that translates high level language commands to executable form (machine language).

Assembler - An assembly language translator.

Interpreter - A machine resident program that translates computer instructions as they are executed. Sacrifice speed for ease of development.

Operating Systems

Single User

- CPM-80
- MS-DOS
- CP/M-86
- P SYSTEM
- TRS-DOS
- Apple-DOS

Multiuser

- MP/M-80
- MP/M-86
- UNIX
- PICK
- TURBODOS
- OASIS

CP/M Commands

DIR -
Displays a Disk Directory.

ERA -
Erases a disk file.

REN -
Rename a File

SAVE -
Copies a portion of memory to a disk file.

TYPE -
Prints a file to the screen.

ASM -
8080 or 8086 Assembler converts assembly program to Hex format.

DDT -
Dynamic Debugging Tool for debugging Assembly code.

Dump -
Unformated display of a disk file.

ED -
CP/M Line Editor.

Load -
For converting programs into machine readable form.

PIP -
Peripheral Interchange Program. Transfers Information between devices. Includes file copy from disk to disk or from disk to communications port.

Submit -
Batch Processing mode that reads commands from a file and executes them as if they were typed from the keyboard.

SYSGEN -
Places a copy of CP/M on a disk.

XSUB -
An extension of submit involving the ability to supply program data.

MS-DOS vs. CPM-86

Command Summary

Function	MS-DOS	CPM-86
Install for Machine	none	Move CP/M(T)
Batch Processing	.BAT	Submit(T)
Supply Batch Info	none	XSUB(T)
Change Diskettes	Pause	Control-C
Display Remark	REM	none
Rename File	RENAME	REN
Assembly to Hex	none	ASM(T)
Intermediate to Com	LINK(T)	LOAD(T)
Change device setting	none	STAT(T)
Change to another user area	none	USER
Compare Files	COMP(T)	none
Compare Disks	DISKCOMP(T)	DUP(T)
Copy between devices	Copy(R)	PIP(T)
Copy Ram to disk	none	Save
Debug Programs	Debug(T)	DDT(T)
Directory	DIR(T)	DIR
Display Free Space	CKDSK(T)	STAT(T)
Erase a File	ERASE	ERA
Format	FORMAT(T)	FORMAT(T)
Create OPSYS	SYS(T)	SYSGEN(T)
Print to Printer	CTRL-P	CTRL-P
Set Date	DATE(T)	none
Set Time	TIME(T)	none

Unix Type Systems

- ONIX – ONYX Systems
- ZEUS – Zilog
- XENIX – Microsoft
- CROMIX – Chromemco
- TNIX – Textronix
- IDRIS – Realtime Systems
- COHERENT – Ithaca Intersystems
- VIRNIX – Micro Data Systems

Operating Systems

System	Application Packages	Machines
CP/M-80	2267	99
CP/M-86	246	9
MP/M	446	29
MP/M-86	58	5
MS-DOS	73	9
USCD P System	184	23
OASIS	714	24
UNIX	251	22

Machine Dependent Applications

Apple	2044	HP	186
TRSDOS	1941	Xerox	172
IBM-PC	1312	ALTOS	160
Heath	359	NEC	80
DEC	349	FORTUNE	12
CHROMEMCO	206		

Reference- PC Clearing House Software Directory (7th ed.)

Utility Programs

File Management

- Format
- Sysgen
- Directory
- Erase
- Copy
- Backup
- View
- Print
- Encrypt
- Compression
- Conversion
- Index
- Organization

Programming

- Editor
- Memory
  - Display
  - Change
  - Move
- Trace
- Assembler
- Submit

Languages

- Basic
- Pascal
- C
- Forth
- APL
- FORTRAN
- COBOL
- Assembler

Section 5

Configurations

Personal Computer Configurations

Configuration	Cost Range	Comments
Telecomputer	$200 - 800	Small display, memory modem, printer
Portables	$1300 - 8000	Tape, disk storage, CP/M
Single User	$2000 - 10,000	Personal computer, CP/M,MS-DOS
Multiuser	$3000 - 20,000	MP/M, UNIX, 16 bit
Super Micro	$8000 - 30,000	UNIX, 32/16 bit

Upgrading Considerations

- Expansion Slots
- Additional Memory
- Power Supply
- I/O Ports
- Graphics
- Disk Storage
- Printer
- Peripherals
- Communications
- Networking
- Processor
- Software

Radio Shack **COMPUTER CENTER**

NEW!

Introducing the TRS-80® Model 100 Portable Computer

The "Micro Executive Workstation"

- **Easy-to-Read 8-Line by 40-Character Liquid Crystal Display**
- **Powerful Built-In Executive Management Software**
- **Self-Contained Direct-Connect Modem with Auto-Dialer**
- **Comfortable Full-Size Keyboard ■ Weighs Less Than 4 lbs.**

799.00 8K RAM

Only $54 a Month on CitiLine Credit

TRS-80 Model 100. So small it'll fit in your in-basket! And when you leave the office, take the Model 100 with you, because it works on batteries. Built-in "instant-on" software lets you use Model 100 as a personal word processor, telephone auto-dialer, address book, appointment calendar and terminal for information services such as Dow Jones News/Retrieval® and CompuServe® through the built-in modem. The extended Microsoft BASIC language makes it perfect for programmers—and they'll appreciate the eight programmable function keys, four command keys and four cursor keys, too. Interfaces include a parallel printer port, an RS-232C port programmable to 19,200 baud and a cassette port that operates at 1500 baud and can be used to interchange tapes with our new TRS-80 Model 4 (see page 9). Internal nickel-cadmium batteries retain memory data for up to 30 days. Requires 4 "AA" batteries. With 8K RAM. 26-3801 ..... 799.00

24K RAM Model 100. As above, but with triple the internal memory. 26-3802 ..... 999.00

8K RAM Memory Upgrade. Increases available memory. Up to three (for 32K total) may be installed. Installation required (not included). 26-3816 ..... 119.00

Direct-Connect Modem Cable. Connects to modular phone jack. 26-1410 ... 19.95

Printer Cable. Connects to parallel printer. 26-1409 ..... 14.95

Sale Prices End 6/26/83—Except As Noted

New Inside: TRS-80 Model 4 Desktop Computer—Pages 8-9 TRS-80 PC-4 Pocket Computer—Page 14

SPECIFICATIONS

CPU and Memory	
Main CPU	CMOS 8 bit microprocessor 6301, 614 KHz clockrate
Slave CPU	CMOS 8 bit microprocessor 6301, 614 KHz clockrate
RAM	16K (standard) expandable to 32K with expansion unit
ROM	32K (standard) expandable to 40K internally; to 64K with expansion unit
Built-in Peripherals	
Display	Liquid crystal screen: 120 x 32 dot matrix, 20 x 4 character display; 5 x 7 font; virtual width to 255 characters by BASIC "width" command
Printer	24-column dot matrix impact microprinter; graphic print rate: 42 lines per minute; bit addressable graphics; full ASCII upper and lower case character set; cartridge ribbon
Clock	Time and calender, alarm, interval timer, built in CMOS battery backup
Tone generator	Programmable pulse drive, four octaves with half-tones
Communications	
RS-232C	Full/half duplex, 110 to 4800 baud rate, 8-pin DIN connector
Serial	Full/half duplex, 150, 600, 4800, 38.4K baud rate, RS-232C level, 5-pin DIN connector
Peripheral Interfaces	
Barcode Reader	HP barcode reader with special connector
Cassette	Standard audio cassette interface
System Bus	16-bit address bus, 8-bit data bus and control lines, 40 pin connector.
ROM Cartridge/ Microcassette Interface	I/O port with 3 input, 6 output lines
Switches, internal	
4 bit DIP	3 bits for international character set selection; 1 bit programmable
Switches, external	
Main power	
Printer on/off	
Reset	

Power Supply	Four NiCd batteries, internal; Sub C type, 1100 mA/H capacity; 50-hour capacity running BASIC (less depending on use of RS-232 port, printer or optional microcassette)
Recharge	Full charge within 8 hours
Keyboard and Character Set	
Type	ASCII
Function	Interruptable
Total number of keys	68
Function keys	5
Special keys	13
Ten key pad	Function locked in by (NUM) key
Graphic shift	32 special graphic characters
International character set	Selectable by DIP switch
Environmental	
Temperatures	
Operating	5-35°C (41-95°F)
Charge	5-35°C (41-95°F)
Data integrity	-5-40°C (22-104°F)
Data storage	20-60°C (-5-140°F)
Humidity	
Operating/Non-operating	10-80% non-condensing
Physical Characteristics	
Size	28.9 x 21.6 x 4.44 cm (11.375" x 8.5" x 1.75")
Weight	1.73 kg (3 lbs. 13 oz.)
Options	
Expansion unit	8K RAM plus 24K ROM or 16K RAM plus 16K ROM. Total expansion is 32K
Microcassette	Uses standard microcassette tapes
CX-20 Acoustic Coupler	
Communications	Full/half duplex, selectable
Operation mode	ORIG/ANS mode, selectable
Signaling speed	Up to 300 BPS
Interface	Standard RS-232C
Power Supply	4 NiCd batteries; AC adaptor (115V ± 10%, 60 Hz); Floating charge with AC adaptor

Specifications subject to change without notice

EPSON
EPSON AMERICA, INC.
3415 Kashiwa Street • Torrance, California 90505 • (213) 539-9140

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Section 6

Hardware

Architecture and Memory

- Processor
- Address Bus
- Data Bus
- Control Bus
- I/O Ports
  - Parallel Port
  - Serial Port
- Clock

- RAM
- ROM
- PROM
- EPROM
- EAROM
- Direct Memory Access
- Access Time
- Cycle Time

Processor Comparisons

Processor	I/O bits	Internal bits	Clock mHz	RAM Bytes
Motorola 68000	16	32	16.	16M
Intel 8086	16	16	10.	1M
Intel 8088	8	16	8.	1M
Zilog Z80	8	8	8.	64K
Intel 8080	8	8	4.	64K
Motorola 6502	8	8	2.	64K
Intel 8085	8	8	2.	64K

Internal Architecture - The word length for internal manipulation.

I/O Architecture - The number of bits transferred on the bus structure.

Address Width - Determines maximum addressable RAM.

Clock Speed - Determines maximum speed of the processor.

Secondary Processors - Auxilary processors for Input and Output operations.

Memory Management - A means of extending the addressable memory.

Cycle time - The time for execution of a single step.

External Bulk Memory

- Floppy
- Winchester Disk
- Removable Hard Disk
- RAM Disk
- Bubble Memory

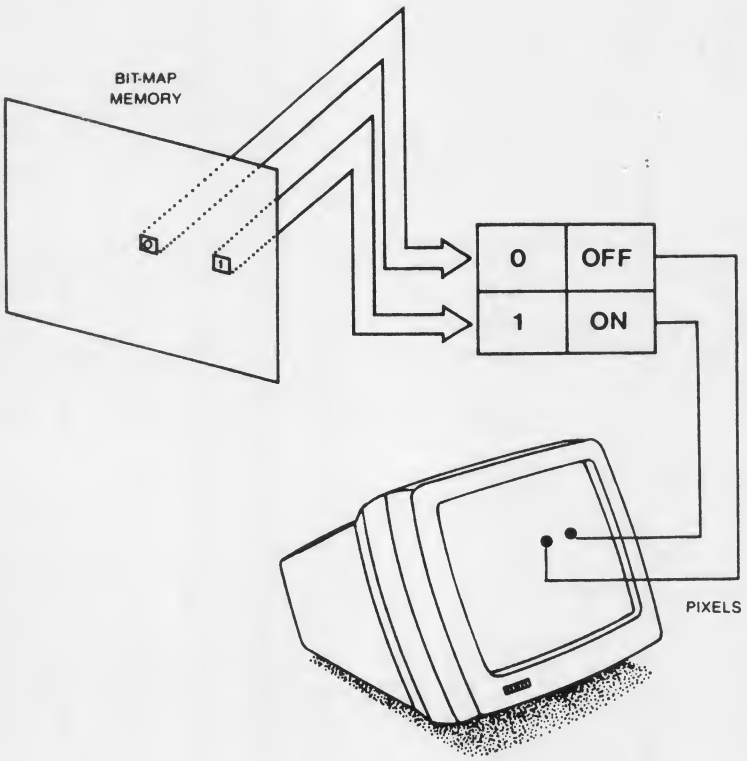
Disk Terminology

- Tracks
- Sectors
- Capacity
- Single Density
- Double Density
- Quad Density
- Double Sided
- Transfer Rate
- Access Time
- Rotation Speed
- Track to Track Time

Removable Hard Disks

	Tecmar 3.9"	Micro-Disk 5.25"
Capacity		
unformatted	6.38 meg	6.38 meg
formatted	5.0 meg	5.0 meg
Recording format		
recording density	12,000 bpi	9,022 bpi
track density	435 tpi	345 tpi
surfaces	2	2
rotational rate	3547 rpm	3600 rpm
Data rate	5.0 meg/sec	5.0 meg/sec
Access time, track to track	3.0 ms	3.0 ms
Average latency	8.33 ms	8.33 ms
Error rate		
hard errors	1 in 10	1 in 10
soft errors	1 in 10	1 in 10
seek errors	1 in 10	1 in 10
Disk size, diameter	3.9 "	5.25"
Cartridge size	4.41x4.33x.43 "	5.551x5.394x.748"
Cartridge weight	5 ounces	11 ounces
Reliability		
MTBF	11,000	11,000
MTTR	30 minutes	30 minutes
Design life	5 years	5 years
Price		
drive	$1,795	$2,295
cartridge	$ 90	$ 119

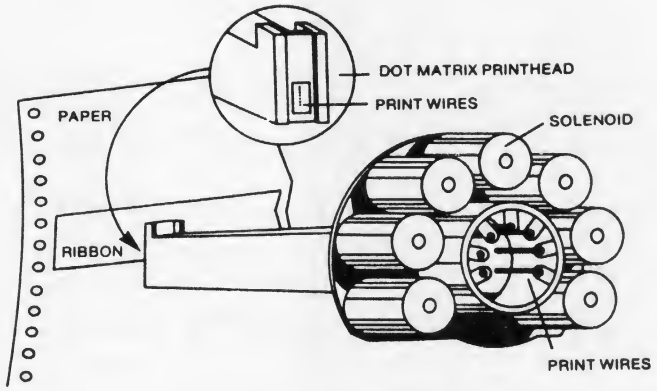
Bit Map Graphics



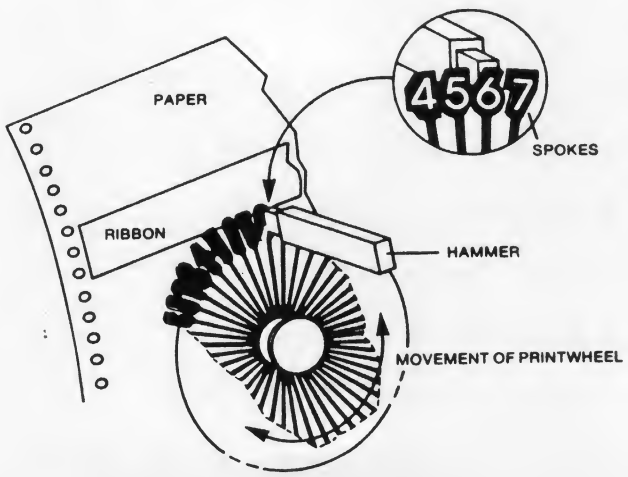
Section 7

Peripherals

Printers



Dot matrix printhead. The wire elements in the printhead strike the ribbon to form a character.



Daisywheel printhead. Each spoke has a raised character which hits the ribbon when the spoke is struck by a hammer.

Printer Checklist

- Print Speed
- Incremental Spacing (1/120")
- Incremental Vertical (1/48")
- Half Line Feed
- Character Size and Fonts
- On Line Fonts
- Proportional Printing
- Draft Mode
- Bidirectional Printing
- Printer Intelligence
- Graphics
- Color
- Maximum Paper Width
- Single Sheet Feed
- Envelope Feed
- Adjustable Tractors
- Friction Feed
- Ease of Changing Ribbons

RED BARON PRINTER COMPARISON CHART

PRINTER COMPARISON CHART

Printer Manufacturer	Model Number	Print Matrix	Speed / CPS	Bi-Directional Printing	Logic Seeking Head	Buffer	Lower Case Descenders	Proportional Spacing	Condensed Print	Double-Width Print	Enhanced Print	Underlining	Block Graphics	Dot Res. Graphics	Adj. Tractors	Friction Feed	Pin Feed	Roll Paper	Auto. Skip-Over Perf	Paper Out Detect	Reverse Line Feed	Lines / Inch	Number of Copies	RS232 Serial	Parallel	IEEE 488	20 MA Current Loop	Top of Form	Paper Width Max.	Ribbon Life x 10⁶ Chars.	$ Mfg. List Price
DOT MATRIX PRINTERS																														
Anadex	9501A	11x9	120	•	•	2.6K	•			•	•		•	72x75	•			•	•	•	1,9	5	•	•			•	15	6	1725
	9620A	11x9	200	•	•	1.5K	•			•	•		•	72x72	•			•	•	•	6,8	5	•	•			•	15	6	1845
	WP6000	18x42	330	•	•	4.5K	•			•	•		•	144x144	OPT	•			•	•	6,8,12,16	4	•	•			•	15	6	3250
Epson	FX-80	9x9	160	•	•		•			•	•		•		OPT	•	•		•	•	VAR	3	OPT	•	OPT	OPT	•	10		699
	MX-100	9x9	80	•	•		•			•	•		•	72x60	•	•			•	•	VAR	3	OPT	•	OPT	OPT	•	15	3	995
IDS	Micro Prism	24x9	110	•	•	1.4K	•	•	•	•	•	•	•	84x84		•	•	•	•	•	VAR	2	•	•			•	9.5	1.5	799
	Prism-80	24x9	200	•	•	3.1K	•	•	•	•	•	•	•**	84x84	•	•			•	•	VAR	6	•	•			•	10.5	5	999
	Prism-132	24x9	200	•	•	3.3K	•	•	•	•	•	•	•**	84x84	•	•			•	•	VAR	6	•	•			•	15	5	1299
NEC	8023	Nx9	130	•	•	2K	•	•	•	•	•	•		144x160	•	•				•	VAR	3		•			•	10	3	795
Okidata	92	9x9	160	•	•		•	•	•	•	•	•	•		OPT	•				•	6,8	4	OPT	•	OPT		•	9.5	3	899
	93	9x9	160	•	•		•	•	•	•	•	•	•		•	•				•	6,8	4	OPT	•	OPT		•	16	3	1249
	84	9x9	200	•	•		•	•	•	•	•	•	•	72x72	•	•				•	6,8	4	OPT	•	OPT	OPT	•	15	3	1395
Star Micronics	Gemini 10	9x9	100	•	•	2.3	•	OPT	•	•	•	•	•	120x144	•	•		•	•	•	VAR	2	OPT	•		OPT	•	10		$CALL
	Gemini 15	9x9	100	•	•	2.3	•	OPT	•	•	•	•	•	120x144	•	•		•	•	•	VAR	2	OPT	•		OPT	•	15		$CALL
Toshiba	P1350	Nx24	160	•	•		•	•	•	•	•	•	•		OPT	•				•	VAR	3	SPC	SPC			•	15		2195
LETTER QUALITY PRINTERS																														
Brother	HR-1	FC	16	•	•	2K	•			•	•				OPT	•				•	VAR	5	SPC	SPC			•	16.5	VAR	1250
NEC	3500	FC	33	•	•		•	•		•	•		•**	48x120	OPT	•				•	VAR	8	SPC	SPC		OPT	•	16	VAR	2290
	7700	FC	55	•	•		•	•		•	•		•**	48x120	OPT	•				•	VAR	8	SPC	SPC		OPT	•	16	VAR	3055
Smith-Corona	TP-1	FC	12				•				•				OPT	•					3,4,6	2	SPC	SPC			•	13	VAR	895

KEY: FC = Fully formed character
OPT = Optionally available
VAR = Variable line spacing
SPC = Specify

LAST UPDATED 4/87
*Optional
**Backspace Underscore

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Letter Quality Printers

Company	Model	Speed cps	Width inches	Feed	Cost
Anderson-Jacobsen	AJ833	45	15	F	$3650.
C. Itoh	F-10	55	16	FT	$2595.
Computers Intl.	2000	16.5	16	FTS	$2595.
Comrex Intl.	CR-1	17	16.5	FTS	$1199.
CPT Corp.	R5	40	15	FTS	$3200.
Datapoint	9611	30	16.5	FT	$3495.
	9601	45	16.5	FTS	$4495.
Diablo Systems	620	25	15.2	F	$1595.
Dynax	HR1	20	16.5	FT	$1150.
Data Royal	4565	40	16	FTS	$1895.
Innovative Elect.	202	660	16	T	$5495.
NEC	3500	35	16	FTS	$1995.
	7750	55	16	FTS	$2535.
Qume	1150	50	15	FT	$1776.
Smith Corona	TP-1	12	13	F	$ 895.
Olivetti	30	12	12	F	$ 839.
Tandy	III	43	16	F	$1960.
Victor	6040	40	16	FT	$2995.
Wang	6581	35	21	FTS	$7500.
Williams		12	12	F	$ 795.
Xerox	1730	40	16	FT	$2395.

Dot Matrix Printers

Company	Model	Matrix	Speed cps	Width "	F	G	Feed	Cost
Amperex	GP300	35x50	300	13.4	y	y	TFS	$2685.
Anadex	WP6000	Nx18	330	15.	y	y	TFS	$3250.
Centronics	122	11x8	120	15	n	y	T	$ 850.
C. Itoh	1550	Nx9	120	15.5	y	y	TF	$ 995.
Data Impact	DIP-92	11x9	100	8.5	n	y	TF	$ 695.
Datapoint	9621	9x9	160	15.	y	n	T	
Dataproducts	M-200	7x7	132	15.	y	n	T	
Datasouth	DS180	9x7	180	15.	n	y	TF	$1595.
Epson America	MX-100	18x18	100	15.5	y	y	TF	$ 995.
Facit/Dataroyal	4575	9x9	225	15.	y	y	TF	$3995.
Florida Data	OPS120		600	15.	y	y	TS	$3900.
General Elec.	GE318	9x18	180	13.6	y	y	F	$2360.
Hi-G Co	9/80	9x18	150	16.	y	y	T	$ 995.
Infoscribe	500	9x9	150	16.	n	n	T	$1595.
Integral Data	P132	24x9	220	14.9	y	y	TS	$1499.
Irwin-Olivetti	TH240	5x7	80	8.5	y	y	F	
Mannesmann Tally	MT 1600	40x18	200	15.3	y	y	TFS	$ 845.
Micro Periph.	P99	11x9	100	15.	n	y	TFS	$ 995.
Okidata	MS 83A	13x17	200	16.	n	y	TF	$1395.
Panasonic	P1160	9x13	196	15.	n	y	TF	$1850.
Printek	910	9x9	200	16.	y	y	T	$1925.
Quantex Div.	7530	24x18	232	15.	y	y	T	$1995.
Star Micronics	G15	9x9	100	15.5	y	y	T	$ 645.
Tandy	DMP100	5x7	80	8.	n	y	TF	$ 399.
Texas Inst.	810	23x28	220	15.	y	y	T	$2495.
Toshiba America	P1350	24x24	160	15.	y	y	TFS	$2195.
Victor Business	6020	9x9	80	14.	y	y	T	$ 995.
Wang Lab.	5577	96x32	192	15.	y	y	FS	$5975.

Modems

Definition – A modem is a computer's telephone. It is their means of talking over the phone line.

Classifications

- Direct Connect
- Acoustic Coupler
- Synchronous/Asynchronous
- Half/Full Duplex
- Data Rate (BPS)
- Auto Dial
- Auto Answer
- Modulation Technique
- Standards

Plotters Vs. Printers

Raster Imaging.... Printer

Vector Imaging.... Plotter

Computer Plotters

Company	Size	N	S	Char	Arc	Dot	Int	Price
Amdek Corp.	10x14	4	3	Yes	Yes	Yes	Cent	$ 749
Calcomp/Sanders	49	4	8	Yes	Yes	Yes	Cent	
Data Design Logic	25x37	1	6	No	Yes	No	RS232	$9,950
Hewlett-Packard	8.5x11	2	15	Yes	No	Yes	RS232	$1,550
* Houston Instru.	8.5	1	4.2	Yes	Yes	Yes	RS232	$ 995
Nicolet-Zeta	11	8	20	Yes	Yes	Yes	RS232	$ 950
Numonics	8.5	1	3	Yes	Yes	Yes	RS232	$1,295
Panasonic	8.6	6	16	Yes	Yes	Yes	RS232	$1,995
Strobe	8.5	1	3	No	No	No	RS232	$ 795
Tektronix	11x17	3	22	Yes	No	No	RS232	$4,600
Watanabe	14x10	1	5	Yes	No	Yes	RS232	$1,190
Yokogawa	11.3	4	4	Yes	Yes	Yes	Cent	$1,150

Other Peripherals

- Voice Recognition
- Speech Synthesis
- Light Pens
- Mice, Joystick, Trackball
- Touch Screens — HP
- Graphic Tablets
- Integration with Video

Silent jet printing

During operation, constant negative pressure is maintained inside the ink channels, except at the instant a droplet is ejected. A concave meniscus forms inside the nozzle, and any ink on the outer tip is drawn inside by the negative pressure, thus keeping the nozzle clean. Ink droplet ejection is induced through a shock wave generated by a piezoelectric transducer, subjected to a momentary electric field. This causes a quick increase in pressure within the nozzle. Figure 3 illustrates the resultant ink droplet ejection in terms of time and distance. The meniscus begins to bulge outward. A bulb of ink moves outward from the nozzle and forms itself into a droplet with a long, trailing tail. The tail breaks away as it hurtles toward the printing surface in the form of a droplet. Figure 3 also shows the flight of several hundred ink droplets photographed in sequence, using a synchronized flash technique. The sharp contours of the ink droplets are indicative of the stability and uniformity of this printing method.

Since the droplets can be released individually on demand, there is no need to catch droplets and rechannel ink. Since the negative pressure method leaves the nozzle tip ink free, a large number of nozzles can be arranged in a dense array.

The 2712's ink supply is contained in an easily-replaceable cartridge, providing enough ink for 5 million characters. Ink supply level is electronically monitored; a flashing lamp on the operator's panel indicates low ink supply.

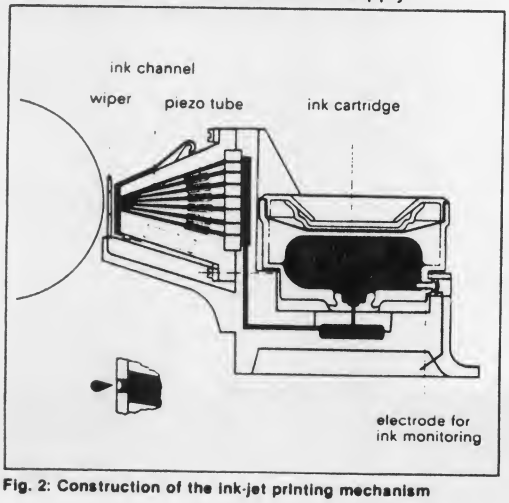


Fig. 2: Construction of the ink-jet printing mechanism

Viscosity, surface tension and drying characteristics of the ink are matched to the printing system in the best possible way. The black dye penetrates the paper quickly. The print-out is lightfast and indelible. Figure 4 illustrates, in highly enlarged form, the standard type print characters (10 CPI) produced by the 2712 ink-jet printer.

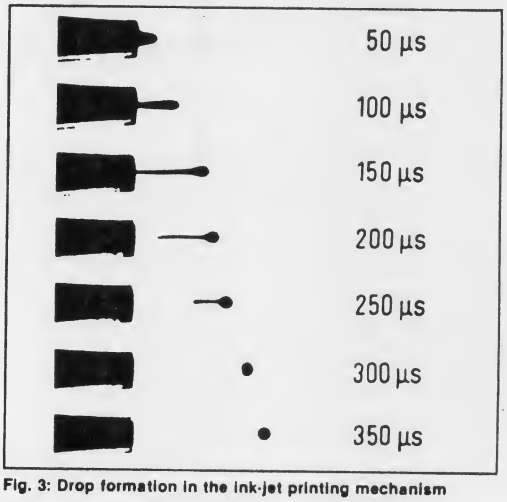


Fig. 3: Drop formation in the ink-jet printing mechanism

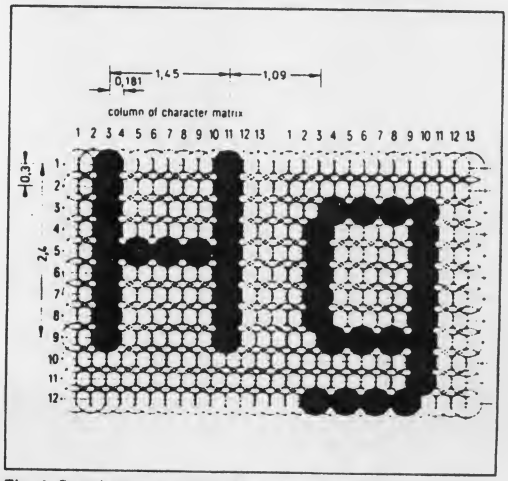


Fig. 4: Standard type print characters (10 cpi)

SIEMENS MODEL 2712 INK-JET PRINTER

The Model 2712 Ink jet printer represents the latest developments in printer technology with cost advantages. Three basic configurations are available for your requirements

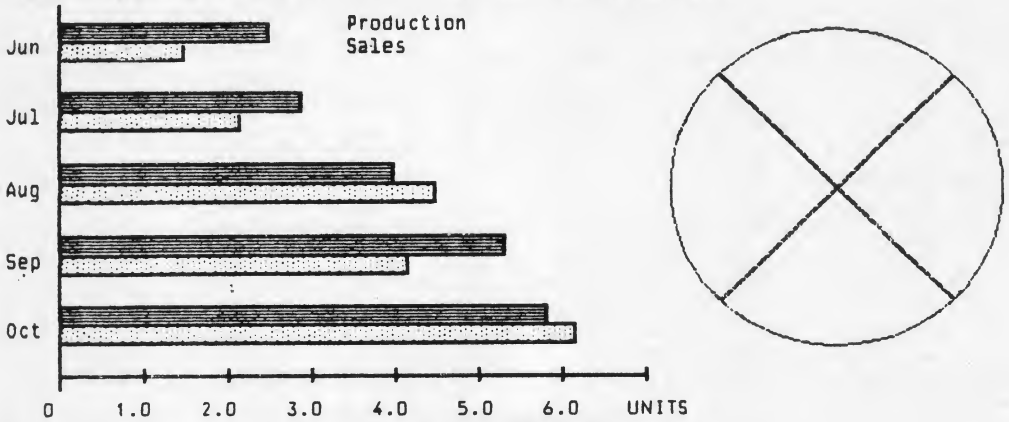
M202	M201	M203
8-1/2 INCH FRICTION FEED ROLL PAPER	14-7/8 INCH PIN FEED FANFOLD PAPER	8-1/2 TO 15-3/4 INCH TRACTOR FEED VARIABLE FANFOLD PAPER

ALL OF THE MODEL 2712 PRINTERS INCLUDE THE FOLLOWING FEATURES...

- **FAST** 270 CPS, Optimized bidirectional printing
- **EXCELLENT PRINT QUALITY** 9 BY 12 DOT matrix with descenders
- **THREE ON-BOARD INTERFACES** RS232-C...8-BIT Parallel...20 mA Current loop
- **EIGHT CHARACTER SETS:**
  - USASCII
  - SWEDISH
  - DANISH/NORWEGIAN
  - GERMAN
  - ENGLISH
  - FRENCH/BELGIUM
  - INTERNATIONAL
  - DUTCH
- **DOWNLOADABLE CHARACTER GENERATOR** 96 CHARACTERS
- **PROPORTIONAL CHARACTER SPACING**
- **HORIZONTAL AND VERTICAL TABULATION**
- **CHARACTER PITCH PROGRAMMABLE VIA THE INTERFACE:**

```
    5 C.P.I. -  ABCDEFGHIJKLMNOPQRSTUVWXYZ
    6 C.P.I. -  ABCDEFGHIJKLMNOPQRSTUVWXYZ
 8.25 C.P.I. -  ABCDEFGHIJKLMNOPQRSTUVWXYZ
   10 C.P.I. -  ABCDEFGHIJKLMNOPQRSTUVWXYZ
   12 C.P.I. -  ABCDEFGHIJKLMNOPQRSTUVWXYZ
16.25 C.P.I. -  ABCDEFGHIJKLMNOPQRSTUVWXYZ
```

- **GRAPHICS CAPABILITIES** BIT IMAGE...RASTER SCAN...BLOCK



FOR MORE INFORMATION REGARDING OUR MODEL 2712 PRINTER CONTACT:

SIEMENS COMMUNICATIONS SYSTEMS, INC.
OFFICE TERMINALS DIVISION
240 EAST PALAIS ROAD
ANAHEIM, CALIFORNIA 92805
(714) 991-9700

Print Samples

Anadex 9501A

```
THIS IS MY 16.7 CPI MODE
 !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~¿
THIS IS MY 15 CPI MODE
 !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~¿
This is my 12 cpi mode
 !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~¿
This is my 10 cpi mode
 !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijk
```

IDS Prism/Microprism 480

```
This is my 16.7 CPI mode with proportional spacing
 !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~¶
This is my 12 cpi mode with proportional spacing
 !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~¶
This is my 5 cpi mode
  !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOP
This is my 10 cpi mode
 !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijk
```

NEC 8023

```
This is my 12 cpi mode !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abc
jklmnopqrstuvwxyz{|}~
THIS IS MY 16.7 CPI MODE !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~
This is my 5 cpi mode with proportional spacing
 !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQ
TUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~
This is my 10 cpi mode !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTU
Z[\]^_`abcdefghijklmnopqrstuvwxyz{|}~
```

Okidata 84/92/93

```
This is my 17 cpi mode
 !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~¶
This is my 12 cpi mode
 !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz
This is my 10 cpi mode
 !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijk
This is my 5 cpi mode
  !"#$%&'()*+,-./0123456789:;<=>?@ABC
```

Star Micronics Gemini 10/15

```
This is my 16.7 cpi mode
 !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}
This is my 10 cpi mode with double strike feature
 !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijk
pqrstuvwxyz{|}
This is my 5 cpi mode
This is my emphasized print mode
 !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijk
pqrstuvwxyz{|}
```

Toshiba P-1350

```
This is my High Speed (160 cps) print style...
 !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijk
This is my High Quality (78 cps) print style...
 !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijk
This is my LetterPerfect proportional (100 cps) print style...
 !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijk
```

Smith-Corona TP-I text printer

Simplicity Equals Durability Plus Dependability

Top of Form: In TOF mode, the printer automatically advances the paper to the top of the next form after printing the 58th line or on recognition of ASCII Form Feed character.

On/Off Switch: Located at right rear, out of way, adjacent to power cord.

Line spacing: Six lines per inch or can be manually set to 4 or 3 lines per inch.

Impression Control: Easily adjustable 5 position switch which allows printing on up to 5 carbons using onion skin or 20 lb. bond with 2 second sheets.

Paper Handling: Design of the printer offers simple initial alignment of single sheet paper or forms. The paper release lever allows insertion of multi-copy paper of up to .022 inch thickness.

Optional tractor feed available.

SPECIFICATIONS

Print Speed: 12 CPS
Character Set: 128 ASCII, 88 printable
Character Spacing (pitch): 10CPI or 12 CPI
Printing: Unidirectional
Paper Width: 13" (33cm) maximum
Writing Line: 10.5" (26.7cm)
- 105 character line in 10 pitch
- 126 character line in 12 pitch

Line Spacing: 6 lines per inch (4 or 3 lines per inch manually selectable)
Paper Feed: Friction: single sheet or forms
Paper Thickness: .022"
Impression Control: Operator selectable 5 level

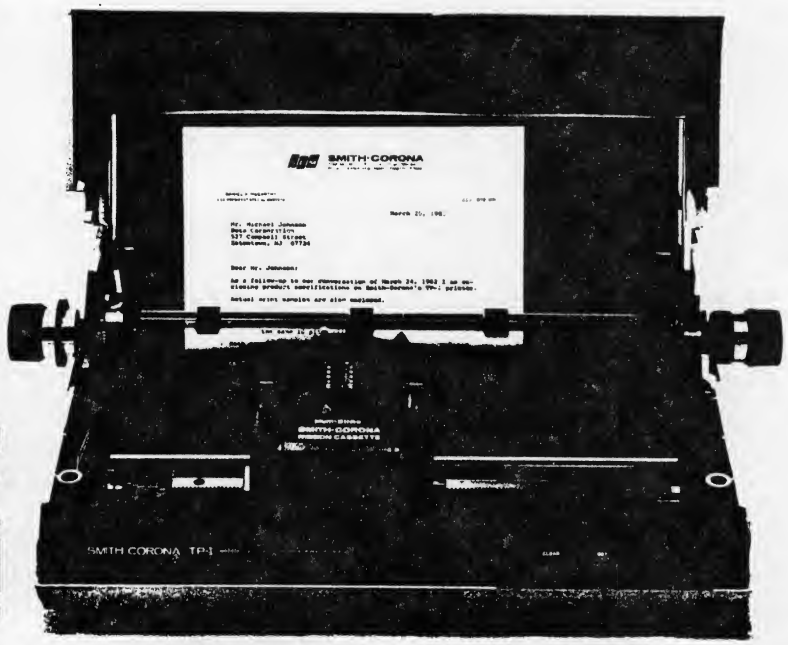
Interface
Parallel: Centronics® compatible 7 bit ASCII data, 3 control lines (Data Stobe, Busy, Acknowledge)
Serial: EIA RS232C Baud Rate (50-19,200), Parity, and Character Bit Length are dip switch selectable.
Power Requirements: 117VAC ± 10% 60HZ; 240VAC ± 10%, 50HZ; 120W
Physical Dimensions: 6.4" (16.25cm)H 19.5" (49.5cm)W 12.4" (31.5cm)D 18.5 lbs. (8.4 kg)

Environmental
Operating: 55°F to 104°F 10 to 80% humidity
Storage: −40°F to 160°F, 5 to 95% humidity (no condensation)
Noise: 63 – 69 dBa (per SCM Spec. #10B10121)
Operator Controls: Power on/off; Top of Forms; Impression Control: Line Spacing

Printer Supplies
Printwheel
Life: 2 million characters
Style – various styles available in modern and traditional faces. See up-to-date listings for complete selection.
Wheel Composition: Nylon reinforced with glass
Configuration: 88 petals
Types, Color, and Life
Multi-strike Mylar – Black 240,000 characters
Nylon Fabric – Black 250,000 characters
One-time Film – Black 57,000 characters
Lift-Rite – Black 57,000 characters
Lift-Rite Colors – Red, Blue, Green, Brown – 53,000 characters

SCM SMITH-CORONA

Smith-Corona is a registered trade mark of SCM Corporation



The statements made herein are subject to change without notice.

For additional information please contact:

SMITH-CORONA
CONSUMER PRODUCTS DIVISION, SCM CORP.
65 LOCUST AVENUE
NEW CANAAN, CT 06840

Phone (203) 972-1471

TILITH CPE 0726 Printed in U.S.A. 183

CORVUS SYSTEMS

THE CORVUS MIRROR

Provides backup for CORVUS disks on video-tape

BACKUP SECURITY

The CORVUS MIRROR lets you copy data from a CORVUS disk onto inexpensive video tape cassettes using a standard video cassette recorder. Within minutes, you can transfer the entire contents of a 10 MB disk onto a tape cartridge.

You can create backup copies of data on your CORVUS disks onto a removable medium offering total storage capacity of 73 million bytes. The video tape cassettes provide extra security against disk data loss.

THE MIRROR CREATES A 'REFLECTION'

The MIRROR lets you create a perfect 'reflection' of your data on a video tape cassette. This exact image is made by the MIRROR's controlling program that functions as an intelligent interface between your Corvus disk system and the video cassette recorder. Software in the host computer allows you to copy an entire disk or a part of a disk. The host computer handles four commands: BACKUP, RESTORE, VERIFY and INDENTIFY.

BACKUP	transfers data from disk to tape.
RESTORE	transfers data from tape to disk
VERIFY	detects errors Ensures normal operation
IDENTIFY	identifies the image on the tape

LOW-COST ARCHIVAL STORAGE

The MIRROR provides a means of creating efficient and inexpensive archival storage for large databases. The video cassettes allow for quick and easy retrieval of files. Video cassettes are widely-available and easy to use, which is why they are an ideal medium for archival storage.

AUTOMATIC OPERATION

With the REMOTE option, the MIRROR can operate the PANASONIC NV 8200 without operator intervention. The MIRROR creates backup copies on cartridges automatically at the end of a work period. It also provides on-line archival storage. Optional firmware allows access to the entire 73 MB tape.

Z-80 CONTROLLER AND BUS

The MIRROR uses the Z-80 controller and bus in the CORVUS disk, making it compatible with all CORVUS products. This microprocessor and interface ensures compatibility with future CORVUS systems as well as the computers currently interfacing with CORVUS disks such as the APPLE II and III, the IBM personal computer, Xerox 820, the TRS-80 models I, II, and III, NEC PC8001, the S-100 Bus machines (Cromemco, North Star and Vector Graphic), Zenith Z89 H89 and Z90, Commodore, the Atari 800, the LSI-11 and others.

DATUM GEMINI SPECIFICATIONS

Modes	Transactional (start-stop) and Streaming
Tape Speeds	45 ips (transactional) and 125 ips (streaming)
Reel Diameter	7 to 10.5 inches
Formats	
Transactional	9 track 800 bpi NRZI 9 Track 1600 bpi Phase Encoded
Streaming:	9 Track 1600 bpi Phase Encoded
Instantaneous Speed Variation	±3%
Long Term Speed Variation	±1%
Nominal Access Time	10 msec (45 ips) 80 msec (125 ips)
Nominal Reposition Time (Streaming Mode)	235 msec
Interchannel Displacement Error	Read — 2.54 microns (100 µin) Write — electrically compensated
Write Reinstruct Time	3 msec
Read Reinstruct Time	3.8 msec
Start-stop Time	8.4 msec at 45 ips
Start-stop Displacement	0.19 ± 0.02 inch
Rewind Speed	200 ips average
Tape Tension	8.0 ± 0.5 ounces
Tape	
Specification	computer grade per ANSI × 3.40 — 1976
Width	0.5 inch
Thickness	0.0015 inch
Power Requirements	
AC Voltage	100, 120, 220, 240 ± 10%
Power	300 watts
Frequency	48 to 60 Hz
Operating Temperature	36°F to 122°F
Operating Altitude	0 to 20,000 ft.
Non-operating Temperature	−80°F to 160°F
Weight	85 pounds
Dimensions	
Height	24.0 inches
Width	19.0 inches
Depth	14.25 inches

datum inc
Storage Systems Division
1363 S. State College Blvd., Anaheim, California 92806
Tel: (714) 533-6333 TWX: (910) 592-1289 TELEX: 68-5579

Dysan Diskettes

Dysan Diskette Specifications

Disc:
Inside Diameter
1.500 inches
Outside Diameter
7.880 inches
Substrate
Polyethylene terephthalate
Coating
Unoriented Fe_2O_3 on both sides
Nominal Thickness
.003 inch (0.076mm) Smooth to within two microinches, CLA
Thermal Expansion Coefficient (maximum)
13.8×10^{-6} inch/inch/°F
$(25 \times 10^{-6}$ cm/cm/°C)
Hygroscopic Expansion Coefficient (maximum)
15×10^{-6} inch/inch/%RH
$(15 \times 10^{-6}$ cm/cm/%RH)

Envelope:
Plastic impregnated, static and dust proof.

Jacket:
8" x 8" square vinyl (PVCA) cover Nonwoven synthetic liner material with an average thickness of 0.008 inch (0.2mm)

Environmental:
Operating and Storage:
8% to 80% RH with a maximum wet bulb temperature of 85° F (29.4° C) 50° F to 125° F (10° C to 51.6° C)
The upper operating temperature limit applies to the warmest exterior diskette surface

Shipping:
8% to 80% RH −40° F to 125° F (−40° C to 51.6° C)

Torque:
Meets IBM's specification when operating on an IBM flexible disc drive (or approved equivalent), i.e., torque necessary to turn the disc in its jacket shall not be less than 4 ounce-inches and not more than 10 ounce-inches with the head and pressure plate loaded and the disc rotating at 360 rpm.

Head Wear:
Meets IBM's specification for head wear when operating on an IBM flexible disc drive (or approved equivalent). After 1,852 hours of wear revolutions (a wear revolution is defined as one diskette revolution with heads loaded normally), evenly distributed over the total recording surface of 40 previously unused test diskettes, the readback signal amplitude of a newly recorded track on a reference diskette will not have been reduced to below 80% of its pre-test value. Testing is done at 75°F and 50%RH.

Media Life:
When operating on an IBM flexible disc drive (or approved equivalent) and reading and writing data continuously on one track with the head(s) loaded normally, the media life will exceed 165 hours. During this 165 hours the disc will operate error free

Certification:
On-track and off-track testing are performed to insure that the entire recording surface of every disc is 100% error free. When testing a given track, bit by bit comparisons for missing and extra pulses are made against the average value for that track. In addition, every track is tested for modulation

Dysan Diskettes are available in any of the following industry standard configurations:

One-Sided—Single Density certified error free at 6631 BPR

Dysan 3740/1:
One index hole located on inside circumference of disc, available in IBM compatible format of 128, 256 or 512 bytes per sector

Dysan 101/1:
Similar to the 3740/1 but with 32 sector holes on the same circumference as the index hole

Dysan FD/IV:
One index hole, 32 sector holes around outside circumference of disc

Dysan 110:
One index hole, 8 sector holes around outside circumference of disc.

Two-Sided—Single Density (two sides certified error free at 6631 BPR).

Dysan 3740/2:
One index hole located on inside circumference of disc, available in IBM compatible format of 128, 256, or 512 bytes per sector

Dysan 101/2:
Similar to the 3740/2 but with 32 sector holes on the same circumference as the index hole

Dysan 151/2:
Similar to the 101/2 but has two index hole apertures punched in the jacket

One-Sided—Double Density (one side certified error free at 13,262 BPR).

Dysan 3740/1D:
One index hole located on inside circumference of disc

Dysan 101/1D:
Similar to the 3740/1D but with 32 sector holes on the same circumference as the index hole

Two-Sided—Double Density (two sides certified error free at 13,262 BPR)

Dysan 3740/2D:
One index hole located on inside circumference of disc, available in IBM compatible format of 256, 512 or 1024 bytes per sector

Dysan 101/2D:
Similar to the 3740/2D but with 32 sector holes on the same circumference as the index hole

Dysan 151/2D:
Similar to the 101/2D but has two index hole apertures punched in the jacket

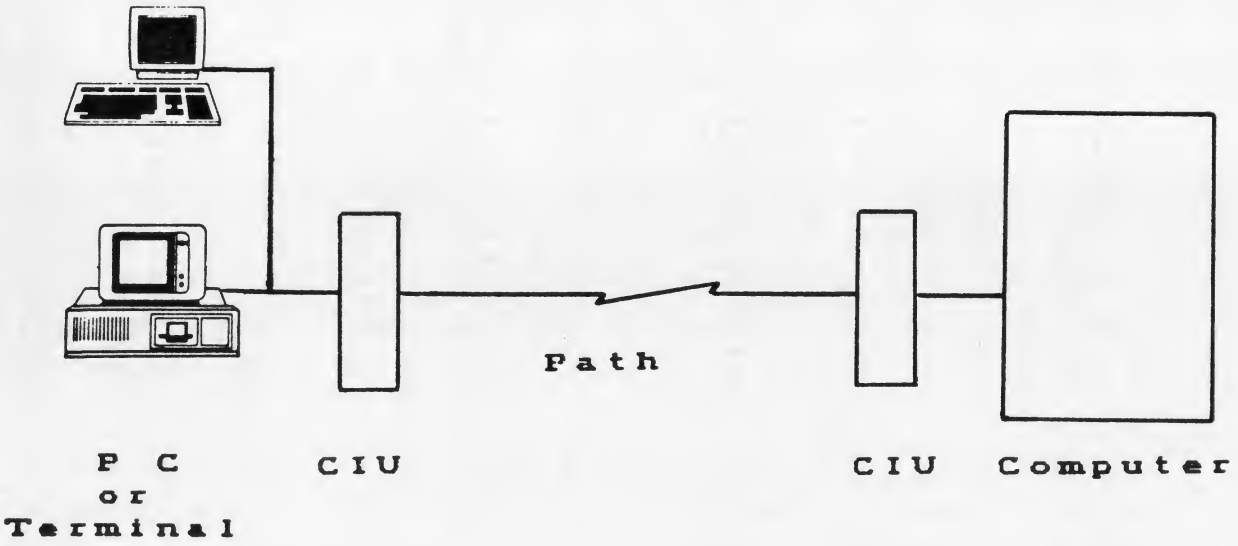
Dysan Alignment Diskettes
Special diskettes used to perform read/write head and index/sector alignment operations. Complete line with different models (soft or hard sectored) available and tailored to specific models of the diskette drives

Dysan 5201 Patrick Henry Dr, Santa Clara, CA 95050 (408) 988-DISC (3472) Toll Free (800) 538-5133 TLX 171551 DYSAN SNTA

Section 8

Communications

Data Communications



Terminology

Data Communications - The transfer of information between two or more computing devices.

Telecommunications - Data communications using the telephone lines.

Path - The medium used for transmission (direct wire, telephone, etc.)

CIU - Communications Interface Unit - A device for converting information to and from digital in a form compatible with the communication path.

Baud - Rate of signal change on the path.

BPS - The information transfer rate in bits per second. It is equal to or greater than the baud rate.

Protocol - The rules of etiquette for communications.

Multidrop line - Two or more devices communicating on the same path. A party line.

Parallel Data Transfer - Information transferred a word at a time. Requires multiple wires.

Serial Transfer - Information exchange a bit at a time. Like the telegraph it requires 2 wires.

Half Duplex (HDX) and Full Duplex (FDX)

The terms half and full duplex are used to describe both a communication path and communication protocol.

1. Path or Circuit
   This is a telecommunications line usually provided by a common carrier and is independent of the information transferred over it.

2. Protocol
   This is the Software controlled sequence of events for data transfer including error correction.

A protocol consists of 2 functions

A. Handshaking - the establishment of, or validation that, a communications path exists and is operable.

B. Line Discipline - the sequence of events to transfer data over a circuit.

HDX Circuit - 2 wires, 1 for data and 1 for "ground". Can be point to point or multipoint.

FDX Circuit - 4 wires (2 pairs), with each pair having 1 wire for data and the others for "ground". Can be point to point or multipoint.

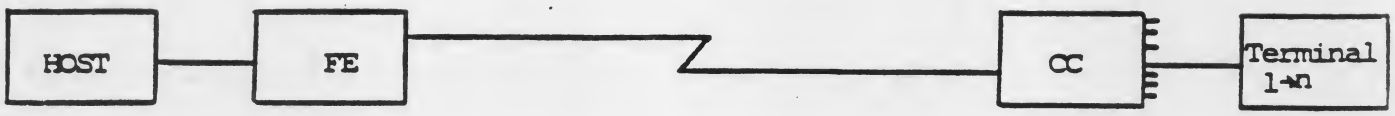
HDX Protocol - Information is transmitted between 2 points, in both directions, but only 1 way at a time. Can be used on a HDX or a FDX circuit.

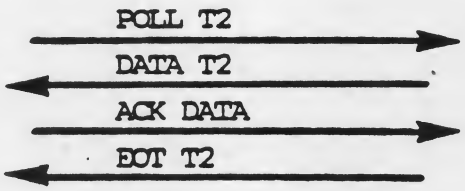
FDX Protocol - Information is transmitted between the same 2 points, in both directions, at the same time. Can be used on a HDX or FDX circuit.

F/FDX Protocol - Full/Full Duplex. On a multidrop line information is transmitted in 2 directions at the same time between a master sight and two different slave sites. Must be on a FDX circuit.

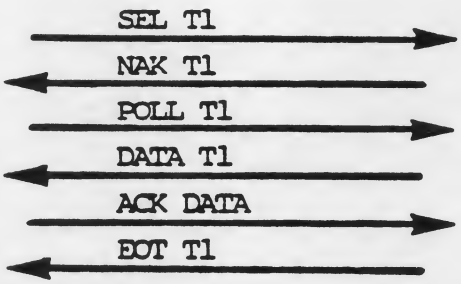
Circuit	Protocol
HDX	HDX
FDX	HDX
FDX	FDX
HDX	FDX
FDX	F/FDX

Polling and Selection

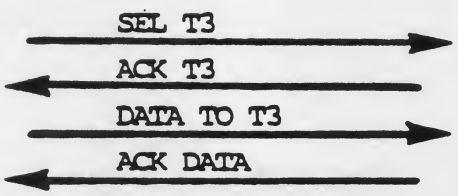




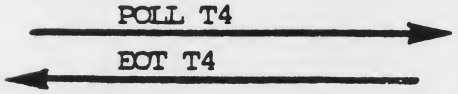
POLL SEQUENCE



SELECT/POLL SEQUENCE



SELECT SEQUENCE



NEGATIVE RESPONSE TO POLL SEQUENCE

Bits	4	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	3	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1
	2	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1
	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
8 7 6 5																	
0 0 0 0		NUL	SOH	STX	ETX	PF	HT	LC	DEL			SMM	VT	FF	CR	SO	SI
0 0 0 1		DLE	DC_1	DC_2	DC_3	RES	NL	BS	IL	CAN	EM	CC		IFS	IGS	IRS	IUS
0 0 1 0		DS	SOS	FS		BYP	LF	EOB	PRE			SM			ENQ	ACK	BEL
0 0 1 1				SYN		PN	RS	UC	EOT					DC_4	NAK		SUB
0 1 0 0		SP										¢	.	<	(	+	|
0 1 0 1		&										!	$	*	)	,	¬
0 1 1 0		–	/										.	%	–	>	?
0 1 1 1												:	#	@	.	=	"
1 0 0 0			a	b	c	d	e	f	g	h	i						
1 0 0 1			j	k	l	m	n	o	p	q	r						
1 0 1 0				s	t	u	v	w	x	y	z						
1 0 1 1																	
1 1 0 0			A	B	C	D	E	F	G	H	I						
1 1 0 1			J	K	L	M	N	O	P	Q	R						
1 1 1 0				S	T	U	V	W	X	Y	Z						
1 1 1 1		0	1	2	3	4	5	6	7	8	9						▪

PF - Punch Off
HT - Horizontal Tab
LC - Lower Case
DEL - Delete
SP - Space
UC - Upper Case

RES - Restore
NL - New Line
BS - Backspace
IL - Idle
PN - Punch On
EOT - End of Transmission

BYP - Bypass
LF - Line Feed
EOB - End of Block
PRE - Prefix (ESC)
RS - Reader Stop
SM - Start Message
Others - Same as ASCII

Code Sets–EBCDIC

American
National Standard Code
for
Information Interchange

Bits	7	0	0	0	0	1	1	1	1
	6	0	0	1	1	0	0	1	1
4 3 2 1	5	0	1	0	1	0	1	0	1
0 0 0 0		NUL	DLE	SP	0	@	P	`	p
0 0 0 1		SOH	DC1	!	1	A	Q	a	q
0 0 1 0		STX	DC2	"	2	B	R	b	r
0 0 1 1		ETX	DC3	#	3	C	S	c	s
0 1 0 0		EOT	DC4	$	4	D	T	d	t
0 1 0 1		ENQ	NAK	%	5	E	U	e	u
0 1 1 0		ACK	SYN	&	6	F	V	f	v
0 1 1 1		BEL	ETB	'	7	G	W	g	w
1 0 0 0		BS	CAN	(	8	H	X	h	x
1 0 0 1		HT	EM	)	9	I	Y	i	y
1 0 1 0		LF	SUB	*	:	J	Z	j	z
1 0 1 1		VT	ESC	+	;	K	[	k	{
1 1 0 0		FF	FS	,	<	L	\	l	|
1 1 0 1		CR	GS	–	=	M	]	m	}
1 1 1 0		SO	RS	.	>	N	^	n	~
1 1 1 1		SI	US	/	?	O	_	o	DEL

Example:

Bits: P*7 6 5 4 3 2 1

1 1 0 0 0 0 0 1 = letter "A" (Odd Parity)
0 0 1 1 1 0 0 0 = number "8" (Odd Parity)

P* = Parity Bit

Code Sets–ASCII

Asynchronous vs. Synchronous

Asynchronous Transmission - Character framed data

Each character has a specific start and stop sequence usually indicated by a change in bit state

Characters may be transmitted one at a time or continuously.

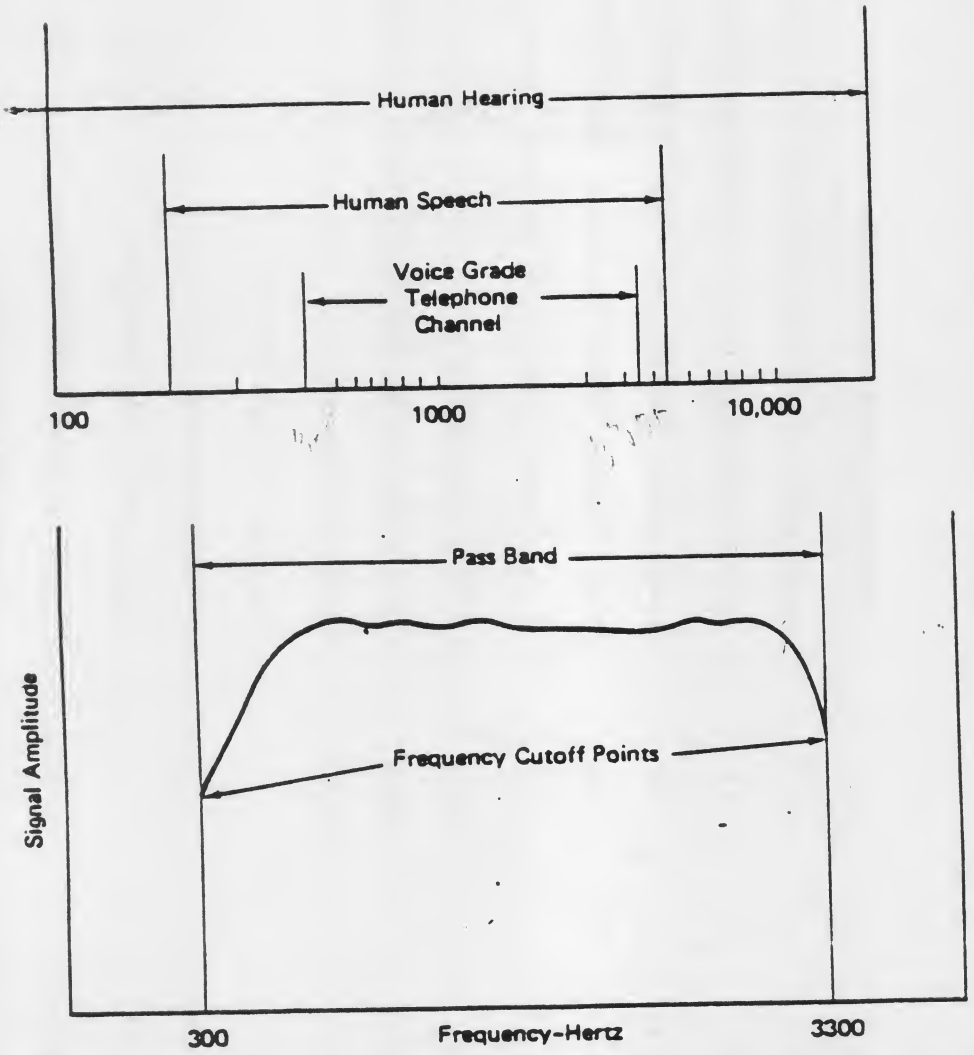
Synchronous Transmission - Message framed data

Each message has a predefined start sequence and end sequence. For transmissions using ASCII code this sequence consists of a SOM character at the beginning and an EOM character at the end. There is also one or more SYNC characters preceding the SOM to insure the modems will have sufficient time to go through bit synchronization.

Synchronous transmission requires a serial port (USRT) capable of synching to clocking pulse from a synchronous modem. It is used for transmission speeds greater than 2400 bps.

The Frequency Spectrum

APPROXIMATE FREQUENCY	NAME	USE
10^3	—	Telephone Voice Frequencies
10^4	VLF	Telephone Voice Frequencies With Higher Speed Modems
10^5	LF	Coaxial Submarine Cables; Some High Speed Batch Data Transfer
10^6	MF	Land Coaxial Cables; Am Sound Broadcasting
10^7	HF	Land Coaxial Cables; Shortwave Broadcasting
10^8	VHF	Land Coaxial Cables; VHF Sound & TV Broadcasting (FM)
10^9	UHF	UHF TV Broadcasting
10^{10}	SHF	Short Link Waveguides; Micro-Wave Broadcasting
10^{11}	EHF	Helical Waveguides
10^{12}	—	Infrared Transmission
10^{13}	—	Infrared Transmission
10^{14}	—	Optic Fibers; Visible Light
10^{15}	—	Optic Fibers; Ultra Violet
$10^{19}-10^{23}$	—	X Rays and Gamma Rays



Telephone Channel Frequency Spectrum

LAN Alternatives

Baseband

Passive Media
Simple Connection
High Speed Channel
Well Specified
Low Maintenance
Low Cost
50 ohm Coax

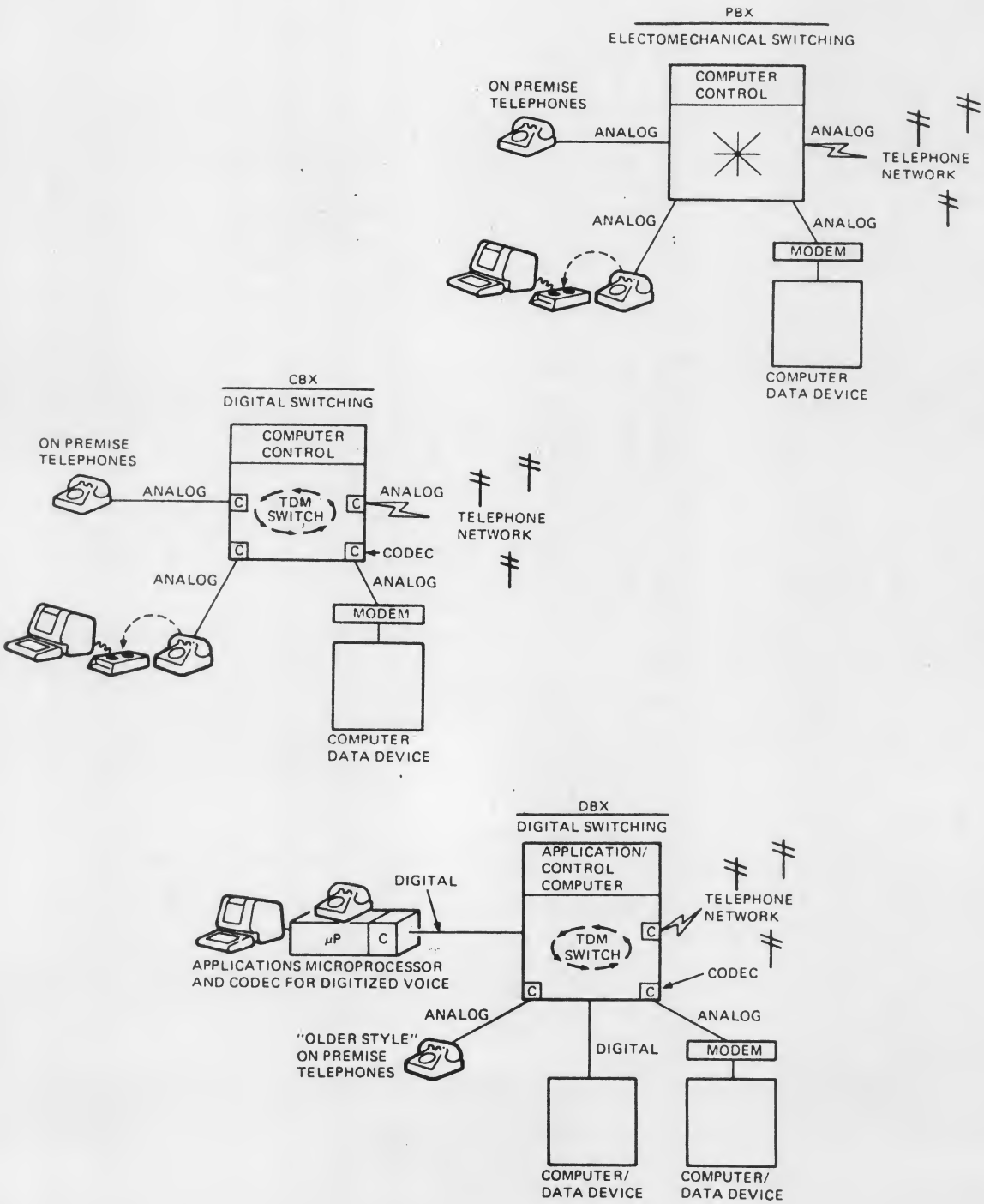
Broadband

Tested Technology
300 MHz Bandwidth
Multiple Channels
Voice, Video, Data
High Capacity
High Rates
High Cost
75 ohm Coax

CBX

Standard Wire
Control
Diagnostics
Broadcast
Includes Phone Network
3 Pair Cable
Centralized Switch
56 K bps
5000 Foot Limitations
No Error Correction

Branch Exchanges



Network Topology

Star

Centralized Control
Simple Protocol
One Device In Use at a Time
High Initial Cost
Difficult to Reconfigure
Widely used
Resource Sharing

Ring

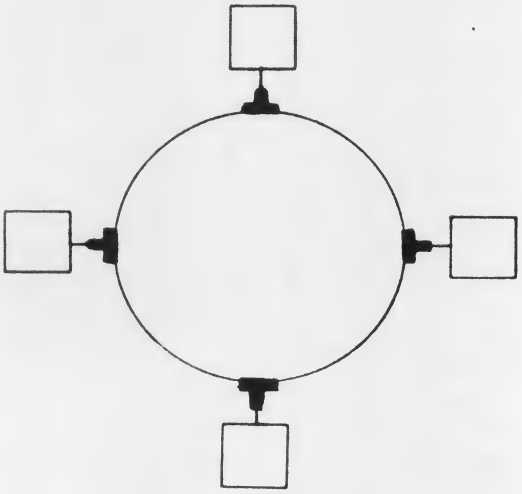
Distributed Control
Simple Protocol
Active Medium
Node Loss is Critical
Computable Delays

Bus

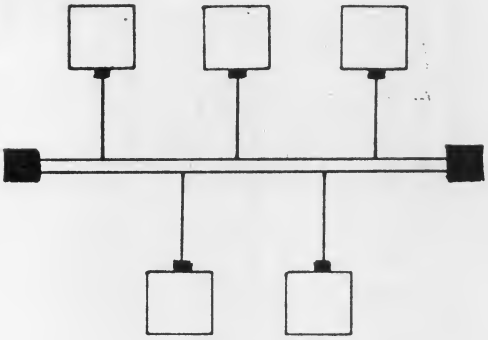
Message Broadcast
Easy to Reconfigure
Decentralized
Widely Used in Cable TV

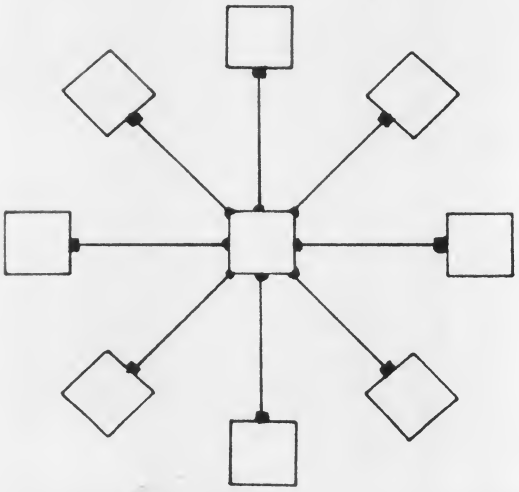
Local Area Network Topologies

Ring Network

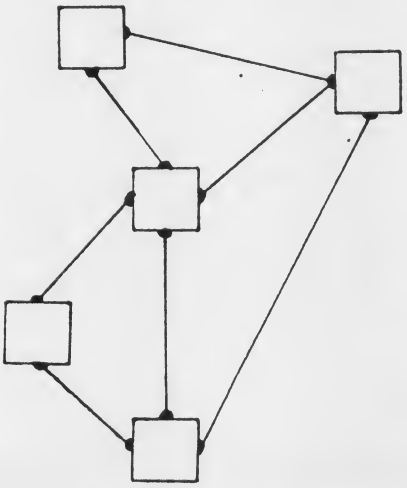


Bus Network



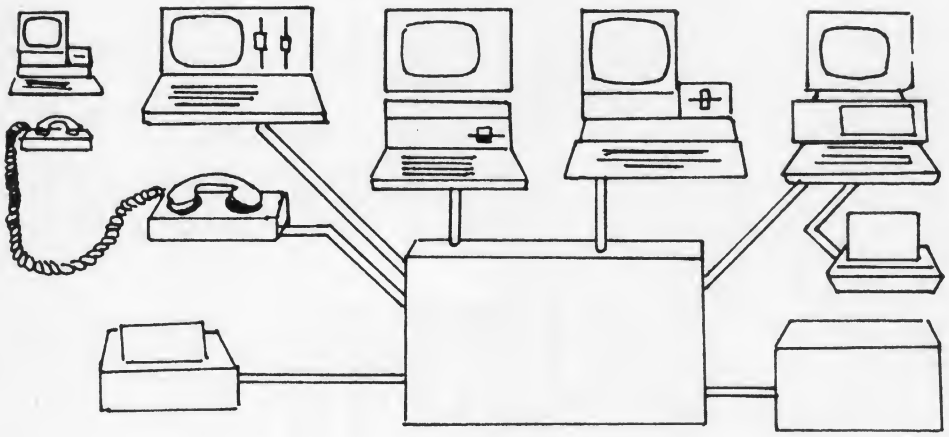


Star Network

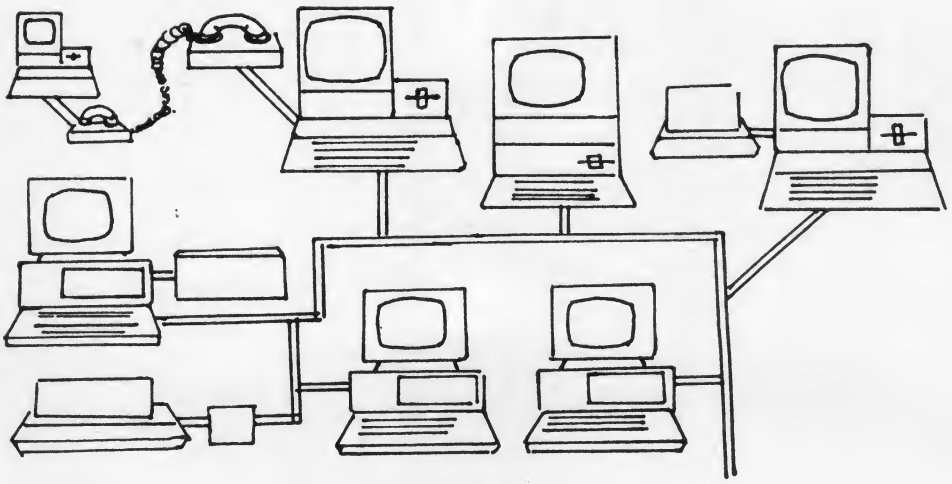


Unconstrained Network

Lan Topologies



Star



Bus

Access Techniques

Polling - Non-contention

Centralized Polling
- o Master Station

Distributed Polling
- o Token Passing
- o Slotted Ring

Contention

Multiple Access
Collision Resolution

Transmission Medium

A.C. Power Lines

- Low Cost
- Noisy Lines
- Very Low Rates

RS232C

- 200 Feet
- Limited Rates
- Standard 19.2
- Up to ~~50~~ K bps
- Terminal Connect
- Printer Connect

Twisted Pair

- Copper Wire
- Up to 800 K bps
- RS-422
- Up to 2000 Feet
- Low Cost
- Available
- Signal Interference
- Security — Low

Coaxial Cable

- Wider Bandwidth
- Transmission to 50 M bps
- Low Error Rates
- Low Interference Level
- Baseband or Broadband

Fiber Optics

- Glass or Plastic Fibers
- 3 GigaHz Bandwidth
- Transmission to 1 Billion bps
- Low Error Rates
- No Interference
- Space and Weight
- Security
- Splicing Problems

Local Area Network Vendors

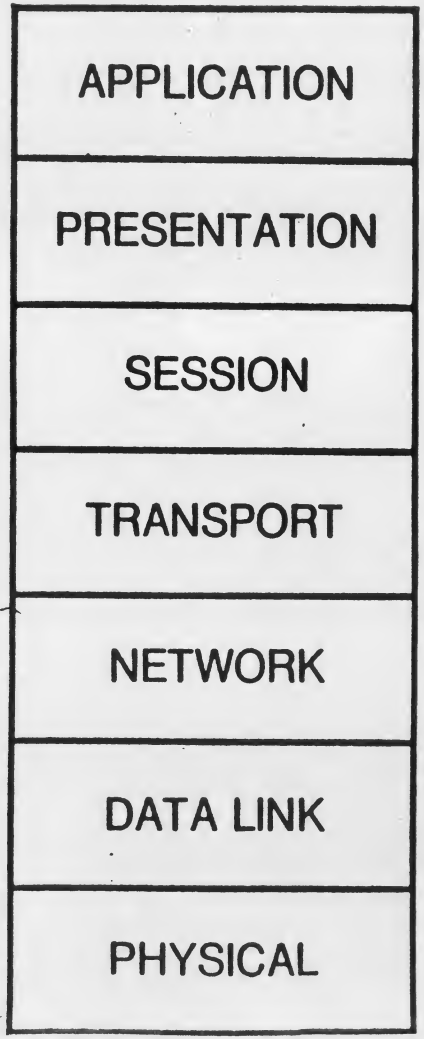
Company	Name	Dist.	Type	Access	Rate	Nodes
AMDAX	CABLENET	75mi	Broadband Coax, Bus	TDMA	14mb/s	16000
Apollo	DOMAIN	3000	Coax, Ring	Token	10mb/s	>100
Corvus	OMNINET	4000	pair, bus	CSMA/PA	1mb/s	64
Datapoint	ARC	4mi	Coax, Bus	Token	2.5mb/s	255
DEC	DATAWAY	3mi	pair, bus	HDCC	56kb/s	31
Digital	INFOBUS	75mi	Broadband Coax, bus	CSMA/CD FDM	1mb/s	256
Gould	MODWAY	3mi	Coax, Bus	Token	1.5mb/s	250
IBM	Series 1	1mi	Coax, Ring	CSMA/CD	2mb/s	16
Interactive	Videodata	40mi	Broadband	TDM	100kb/s	248
LOGKA	POLYNET	NA	Coax, Ring	Slot	10mb/s	NA
NELSTAR	CLUSTER/One	1000	16 wire	CSMA/CD	240kb/s	65
Network	HYPERBUS	3000	Coax, bus	CSMA	6.3mb/s	256
Prime	PRIMENET	750	Coax, ring	Token	8mb/s	200
Stratus	STRATALINK	1500	Coax, ring	Token	2.8mb/s	32
STYTEK	LOCALNET	20mi	Broadband Coax, bus	CSMA/CD	128kb/s	64000
Ungerman-Bass	NET/ONE	4000	Coax, bus	CSMA/CD	10mb/s	200
Wang	WANGNET	2mi	Broadband Coax, bus	CSMA/CD	12mb/s	1000
XEROX	ETHERNET	2mi	Coax, bus	CSMA/CD	10mb/s	1100
ZEDA	INFINET	3mi	Pair, bus	CSMA/CD	25kb/s	30
ZILOG	Z-NET	1mi	Coax, bus	CSMA/CD	800kb/s	255

Micro-Computer LANS

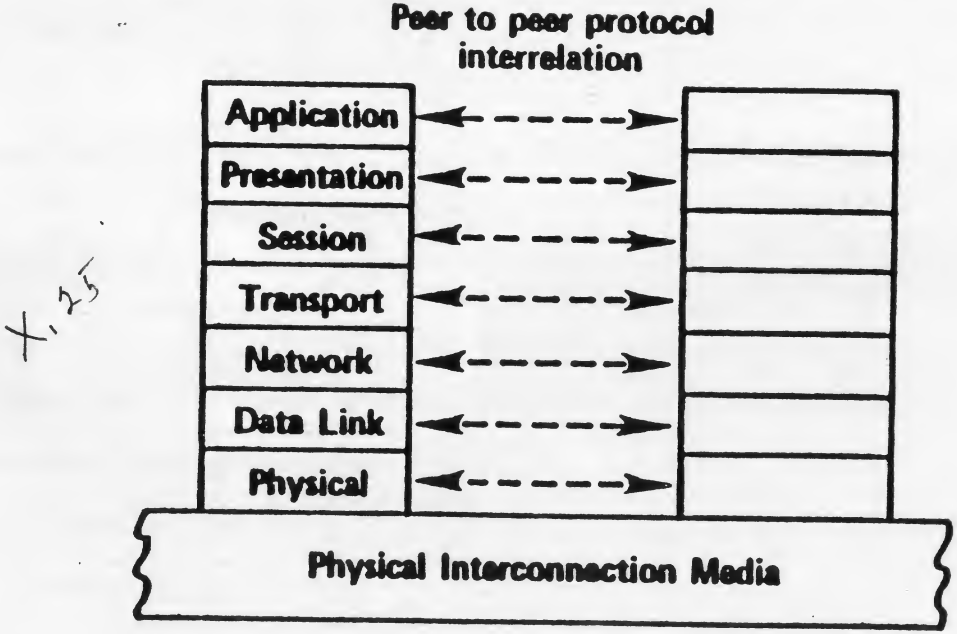
Company	medium	Top	Access	Rate bps	Users
Altos Computer	coax	bus	CSMA	800K	32
Corvus Systems	pair	bus	CSMA/PA	1M	64
Cromemco Inc.	pair	bus	CSMA/CD	880K	255
Datapoint	coax	bus	token	2.5M	255
Digilog	pair	bus	poll	500K	16
Digital Microsystems	pair	star	poll	500K	255
Intertec Data	pair	bus		1.6M	255
Nestar Cluster/One	pair	open	CSMA/CD	250K	65
North Star	pair	bus	CSMA/PA	880K	64
Norvell Data	pair	star		500K	24
Orange Computer	pair	bus	CSMA/CD	400K	60
SDS Systems	pair	bus	CSMA/CD	800K	100

Emerging Standards: Layered Protocols

International Standards Organization Open System Interconnection

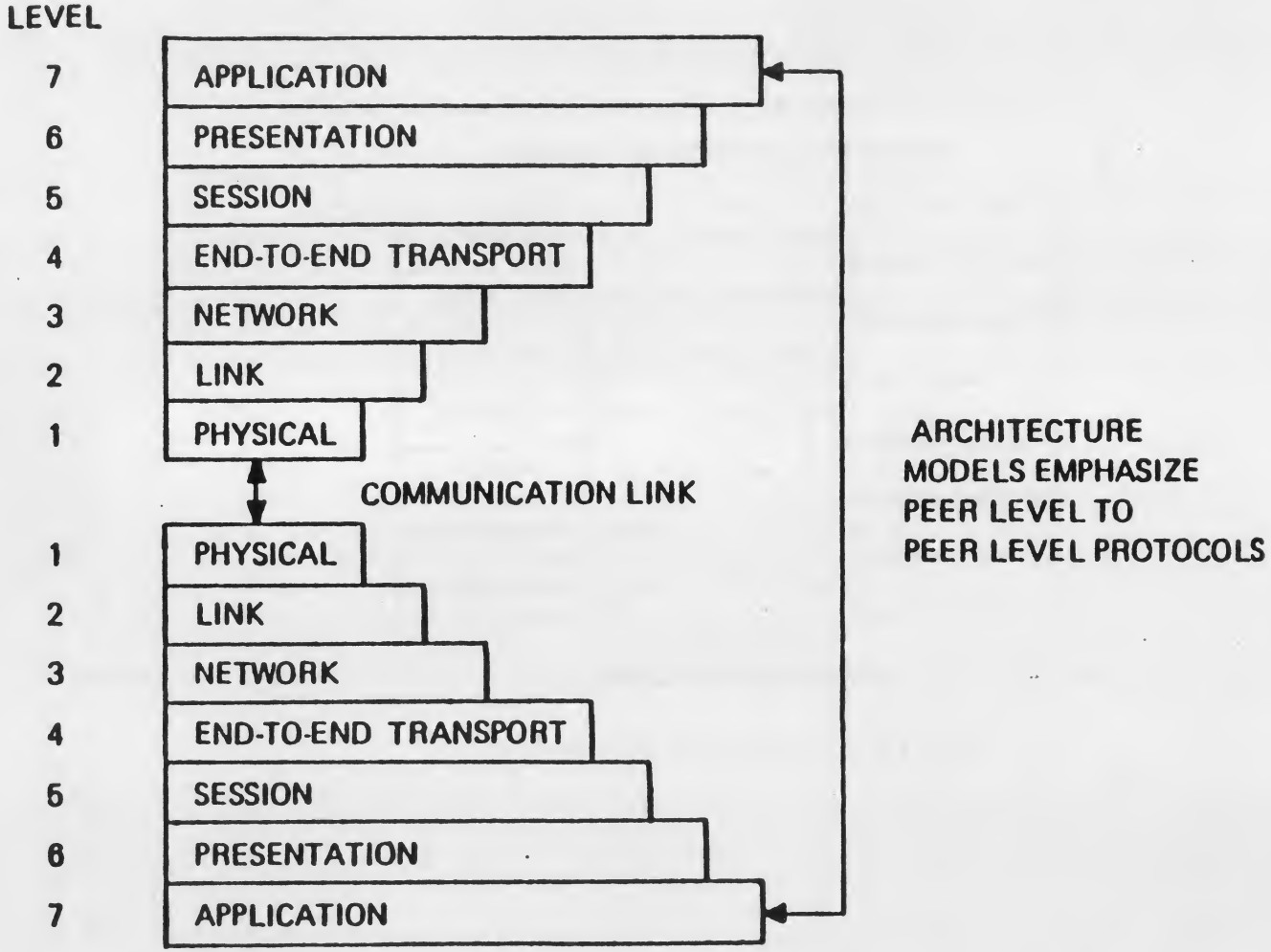


ISO Seven–Layer Reference Model



c IEEE 1980

ISO REFERENCE MODEL



c IEEE 1980

Gateways

- X.25 Packet Nets
- Other LANS
- PBX
- Mainframe
- Minicomputer
- CBBS

LAN Selection

- Topology
- Medium
- Access
- Number of Stations
- Data Rates (capacity)
- Security
- Gateway
- Drop Length
- Maintenance
- Installed Base
- Reconfiguration
- Diagnostics
- Cost
- Type of Devices
- SOFTWARE - CAN IT BE DOWNLOADED TO HARD DISK

CORVUS SYSTEMS

OMNINET™ LOCAL NETWORK
TECHNICAL OVERVIEW

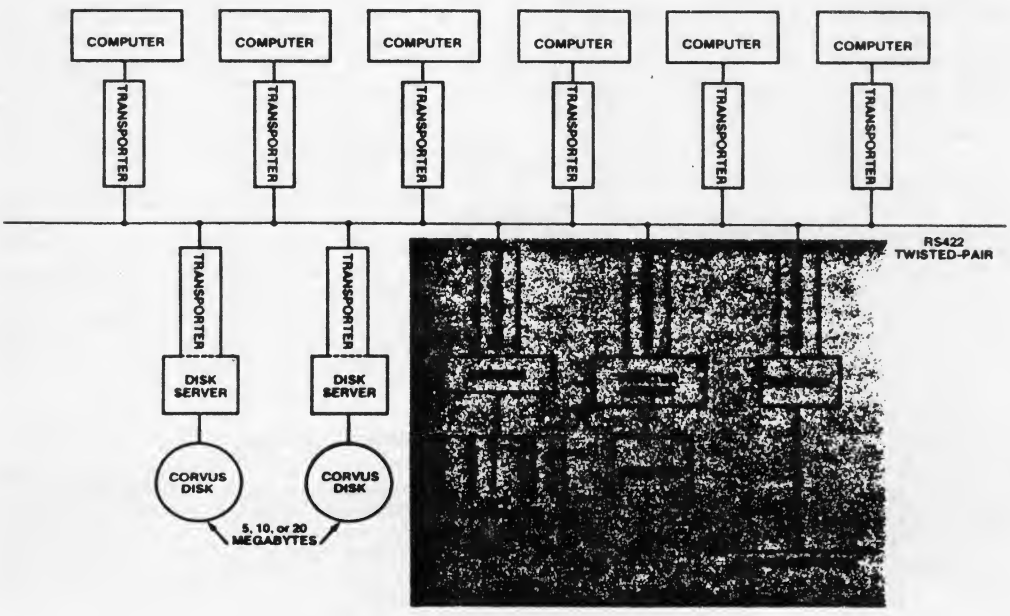
The OMNINET local network supports up to 64 devices sharing a simple RS-422 twisted pair of wires up to 4000 feet in length. It transfers data at the rate of 1 million bits per second.

Each device attached to the OMNINET local network has an interface controller called a transporter. The transporter utilizes a Motorola 6801 microprocessor, a custom gate array integrated circuit to control high speed direct memory access (DMA) data transfers, and associated support components.

The transporter interfaces directly to both the RS-422 serial line and the host computer's memory. Transfer of data to or from the host computer is performed without intervention by host software. Because the data transfer is handled by the transporter and data buffering is not required, high speed data transfers are possible while maintaining a low cost network interface.

The OMNINET local network is a distributed control network and hence, no master controller is required. Network control is assumed by any transporter which has a message to send as soon as the network is available.

OMNINET LOCAL NETWORK



Since OMNINET is a shared access local network that allows any device to transmit at any time, a collision avoidance scheme is implemented in the transporters. Collision avoidance is performed using a combination of two methods. First, the popular Carrier Sense Multiple Access (CSMA) mechanism is utilized to determine when the network is available and second, the transporter computes a randomized transmit start time to minimize the probability of two devices trying to access an available network at the same time.

Unlike many other local networks, OMNINET does not require a collision detection mechanism. This allows OMNINET to be implemented on an RS-422 twisted pair of wires and eliminates the cost associated with collision detection hardware.

AUTOMATIC ERROR DETECTION AND CORRECTION

Error detection, and retransmission activities are performed by the transporters without software intervention. Thus, the host software burden is substantially reduced while overall system performance is improved. OMNINET utilizes a positive acknolwedgment method to insure that a message has reached its destination without error. If a positive acknowledgment is not received for a message, retransmission is automatically performed by the transporter until it is successful, or a user-specified number of retries have been performed. If transmission is unsuccessful, the sending host is informed as to the nature of the error.

FLEXIBLE DEVICE ADDRESSING

Device addressing within the OMNINET local network allows a message to be sent to any device attached to the network or a message broadcast to all devices on the network. In addition to device addressing, OMNINET supports sockets. A socket provides additional addressing capability by allowing a message to be sent to a particular buffer in the selected host microcomputer. Four sockets can be defined for each device to aid in the separation of different types of messages within the host computer.

EASY TO USE MESSAGE COMMANDS

The transporter accepts two major categories of commands from the host computer to control the overall flow of messages within the local network. The two major categories are:

- Send Mesage
- Receive Message

The send message command transmits a message up to 600 bytes in length to any designated host socket. The send message command includes a command code, a result address, a destination host socket number, the message address and length, and an optional message header up to 255 bytes in length. The transporter utilizes DMA to transfer the message and optional message header without additional host software involvement. When the message is delivered, the result status code is set to reflect the status of the transmitted message. Some of the possible results are:

- Message delivered successfully
- Message failed after 'n' retries
- Receiving socket not set up
- Message too long for receiving socket

Receive message commands prepare host sockets to receive incoming messages. The receive message command includes a command code, a result address, a socket number, a data buffer address and maximum message length. The optional message header length is also specified.

When the optional message header is utilized, the header and the actual message can be placed into different locations within the host's memory. This feature allows device drivers to place the message data directly into the user's buffer while placing the header information in the driver's buffer, thus eliminating the need for the driver to move the message data to the user's buffer.

NETWORK PROTOCOLS—CONSTELLATION SOFTWARE AVAILABLE NOW

Various types of network protocols can be implemented using the OMNINET local network. Corvus Systems has implemented its field-proven CONSTELLATION software protocol on the OMNINET local network. The CONSTELLATION software allows multiple computers to share a Corvus disk system. A special disk server device is utilized with the CONSTELLATION software when the OMNINET local network is used. The disk server appears as just another device on the local network to the OMNINET network but performs disk sharing for the other computers on the network. The disk server contains both a transporter network interface and a Corvus disk system interface. Additional shared peripherals will be added to the OMNINET local network in a similar manner.

SPECIFICATIONS

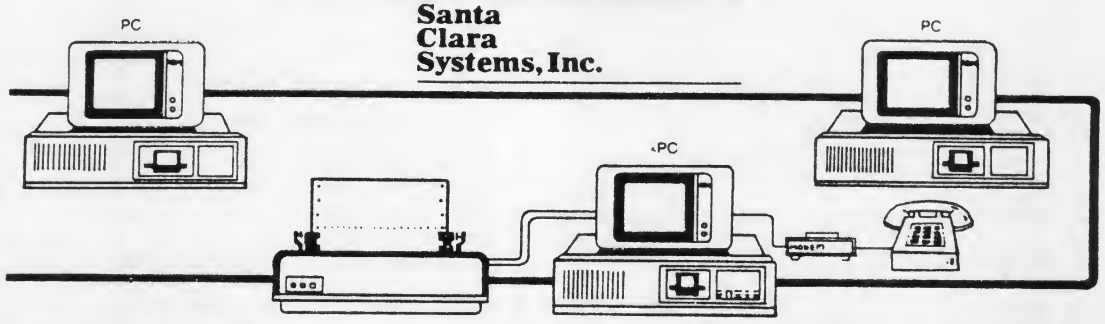
Data Rate:	1 million bits per second
Total Network Length:	4,000 feet (1.21 km)
Number of Devices:	Up to 64
Message Size:	Variable, up to 2 kilobytes
Network Medium:	RS-422 twisted pair wire

CORVUS SYSTEMS

2029 O'Toole Avenue, San Jose, California 95131
Telephone (408) 946-7700 TWX 910-338-0226

Orchid Technology PCnet™ Local Area Network for the IBM Personal Computer

Santa Clara Systems, Inc.



The Orchid Technology PCnet is the first Local Area Network designed specifically for the IBM Personal Computer and its MS-DOS Operating System. PCnet provides low system cost, high performance, and a transparent MS-DOS interface that is powerful yet easy to use.

PCnet will be available on other MS-DOS machines in the future.

LOCAL NETWORKING BENEFITS

There are several good reasons to interconnect microcomputers via a high speed local network. First, a network allows expensive resources such as hard disk units and letter quality printers to be shared, thus reducing the per station cost. Second, it is convenient to share files, programs, etc. among several cooperating users. If users keep all files on a shared disk, there is also the convenience of centralizing backup facilities and procedures. Finally, networking increases the range of applications that can be handled by inexpensive microcomputers.

This last point distinguishes true local networking from other kinds of sharing (e.g. via a switch or multiplexer). Networked micros can be used to build multiuser systems (with one micro per user) traditionally handled by minicomputers, but with the major advantage that initial cost is low and the system can easily expand to handle increased loads. Unlike a centralized system which has a relatively fixed processing and memory capacity, with a network of micros, processing power and memory capacity increase linearly as users are added. The other major advantage of micros is the large pool of application packages available. Their availability is also directly related to the low cost of the development hardware; i.e. the microcomputer

PCnet SYSTEM OVERVIEW

PCnet was developed to achieve the benefits described above. Since it was developed specifically for the IBM Personal Computer and the MS-DOS operating system, it offers better features and is more efficient than more general purpose "connect to anything" networks. PCnet can interconnect up to 64,000 PCs on a network, although at present only one cable per network is supported. This limits the maximum number to that supportable by the cable bandwidth. Refer to the Technical Reference section for more details.

PCnet Hardware

The PCnet hardware consists of a single slot PCnet Adapter board that plugs into each networked IBM PC. On the back of this board is a BNC type connector which plugs directly into the network cable via an inexpensive (passive) tap. The network cable is a standard 75 ohm cable-TV type coaxial cable that runs in a single line throughout the area where the networked PCs are installed. (This is known as a distributed bus topology). The cable can run up to 7000 feet allowing an entire work area to be "pre-wired" and PCs to be added to the network or moved within the networked area very easily; hooking up to the cable is as simple as plugging in the power

The PCnet Adapter uses proprietary CSMA/CD circuitry to share the cable bandwidth among networked PCs. High speed operation is provided by a trasmission speed of approximately 1 Megabit per second, and the use of the PC's DMA (Direct Memory Access) capabilities.

PCnet Software

Each PCnet Adapter comes with software that integrates the network into MS-DOS. This MS-DOS interface is designed so that standard single user PC applications can use the network without change, and more advanced multiuser systems can be developed from single user systems with only minor modifications.

The three main functions of the MS-DOS interface are 1) disk sharing, 2) file locking, and 3) PC sharing (multi-tasking).

Disk Sharing. Disk sharing allows PCs to share hard disks installed in other PCs. This helps solve one of the major PC shortcomings - the lack of storage capacity. The shared or networked disks appear to be locally attached; for example if a PC has one diskette drive and shares a hard disk via the network, the user can access the local floppy as drive "A:", and the shared disk as "B:", "C:", etc. By changing the default drive to a shared drive (i.e. typing b: to get B> prompt), the user can execute programs, store data, etc. directly on the networked drives. The mapping of local drive letters (A, B, etc.) to local and shared drives is totally flexible, so that the A: drive does not have to correspond to diskette drive number 0

This sharing is immediately useful for a multi-PC installation in many ways. First it provides each user with the capacity and speed of a hard disk at lower cost than the hard-disk per user alternative. Second, it simplifies the backup problem - only the PC with the shared disk need be backed up, and the one backup can cover all users' data. Third, each user PC only needs one diskette drive to perform the initial system boot. Finally, it allows users to examine other users data files, and transfer files between shared and local (floppy) storage. (Note that user file protection is provided - refer to technical sections).

The disk sharing interface was designed for compatibility with all exisiting and future IBM compatible hard disks.

File Locking. In order to implement a multi-user, multi-PC application that shares common data files, there must be a mechanism to ensure that common files are only accessed by one user at a time. Since MS-DOS does not currently support file locking, the MS-DOS interface includes function calls to lock and unlock files by name or by name and record

number. The lock call performs a slow loop waiting for the lock to be free before returning.

Using these calls it is relatively simple to convert a single user application to multiuser as follows. First find those sections in the source that modify a common file or files. Then insert a lock function call for all accessed files before the access, and an unlock call afterwards. Then run the modified application in each PC. If two PCs try to modify a common file at the same time, one will simply wait until the other is finished before proceeding. This is the same principle used in all large multiuser systems. (Note that flexibility is provided if the application wants to do something while waiting for locked files - refer to the Technical Reference section.)

PC Sharing (MultiTasking). In order to create a truly distributed processing system with PCnet and MS-DOS, there must be a way to share expensive resources such as printers, communications lines, etc. and to perform multitasking. The MS-DOS interface does this by a feature called "remote execution". This allows a user on one PC to run a command on another PC as if the command had been entered on that PC's keyboard. After the command executes, the user is informed by a short beep on his or her PC. Thus one PC with specialized peripherals can act as an "execution server" for other PCs and can print files, assemble programs, format text, etc. while the user is performing other work. Software compatibility is guaranteed, and any hardware that is plug compatible with the PC is sharable. (For more complete details of this function refer to the Technical Reference section).

Remote execution is also useful for multi-PC applications which can be split into data entry and update/report program sections. User PCs can then run the data entry programs and submit remote commands to do the updating and report generation. If certain programs in an application system require large memory to run, running them exclusively in a common PC with a full memory complement can reduce the total system cost.

PCnet APPLICATION EXAMPLES

Shared PC Word Processing System

This example describes a four user word processing system that shares a hard disk, and both letter and draft quality printers. The word processor provides a full screen editor and uses embedded commands in the text for formatting control. A separate formatting program is used to print the edited text. In this example it is assumed that a

hard disk unit is used that allows the hard disk to be split into multiple volumes.

The system uses five PCs: one acts as a shared printer/formatting station while the other four are used by operators to input and modify stored text. The shared PC contains a diskette drive, a fixed media hard disk unit (e.g. 12 Mbyte), and a disk cartridge unit (e.g. 5 Mbyte) for backup. The hard drive is formatted into 5 volumes with 2.5 Megabytes for each user (approx. 1600 pages). It also contains printer ports to which the printers are attached. The volume to disk mapping on the shared PC is as follows:

Santa Clara Systems, Inc.

560 Division Street • Campbell, California 95008

Volume	Drive	Contents
A:	Fixed, 2Mbyte	Common programs including the full screen editor and formatter. Read Only by all user PC's.
B:	Fixed, 2.5Mbyte	Read/Write file storage for user #1
C:	Fixed, 2.5Mbyte	Read/Write file storage for user #2.
D:	Fixed, 2.5Mbyte	Read/Write file storage for user #3.
E:	Fixed, 2.5Mbyte	Read/Write file storage for user #4.
F:	Cartridge, 5Mbyte	Used exclusively for backup; can backup two users at a time
G:	Floppy	Used to boot and copy programs to program drive A.

Each operator's PC is configured with only one diskette drive (used to boot the system). These PC's have a volume to disk mapping as follows:

Volume	Drive	Description
A:	Network Shared Drive A:	volume containing read only programs.
B:	Network Shared Drive X:	volume assigned as read/write storage for this user.
C:	Local Floppy Drive	volume for local storage.

The operator's procedure is as follows. The default drive is A: so that all programs requested are retrieved from the shared program volume. Drive B: is used to store the text being worked on. When the text is ready for formatting and draft printing, the operator issues a remote command to the shared PC which invokes the formatting program and sends the output to the fast draft printer. During formatting and printing the operator is free to begin on another document. Another remote command is used to format and print on the letter quality printer. Backup is done each day by one person using two cartridges, one per two users.

Mainframe Program Development

Many large mainframes are not well suited to interactive program development (for example on IBM mainframes, the TSO system is very inefficient). They lack good interactive full screen program editors and often provide poor response when heavily loaded. An alternative is to use PCs to write programs and review results. However, mainframe communications lines are expensive and would be poorly utilized if one line had to be provided per PC.

PCnet can provide the following solution. Configure a "shared" PC with a hard disk and the communication line to the mainframe, and link "user" PCs to it via PCnet. The user PCs need only one diskette drive since they will share the hard disk. Assuming a file transfer program exists to transfer programs and output to and from the mainframe, install this program on a hard disk. Users then do program editing on their own PC, and request its transfer and execution on the mainframe via a "remote command" to the shared PC. After the program has been executed, the user again commands the shared PC to transfer the output file into the hard disk, reviews it and modifies the program under development accordingly.

To make this example more concrete, assume that the hard disk can be split into a number of volumes starting with A:. A: can be used to hold all common programs and would be read-only by all user PCs. Volumes B: and up would each be assigned with read/write permission to different users for program development. Each user therefore sees following drive layout:

A:—shared hard disk (read only) containing editors, etc.
B:—shared hard disk (read/write) for data storage.
C:—local floppy drive.

PCnet SYSTEM TECHNICAL REFERENCE

This section describes the features of PCnet in greater technical detail. The description covers Version 1.0 of the PCnet System and MS-DOS interface.

HARDWARE SPECIFICATIONS

PHYSICAL.	Fits in a single IBM PC I/O Slot. Components extend a maximum of 5 inches above PC board.	
POWER.	+5 VDC maximum	1.00 Amps
	+12 VDC maximum	0.15 Amps
	-12 VDC maximum	0.10 Amps
ENVIRONMENTAL.	Operating Temperature 0 to 55 C. Storage Temperature 0 to 70 C. Relative Humidity 0 to 90% (non-condensing)	
PC INTERFACE.	Uses interrupt lines #3, #5. DMA channel #1. I/O port addresses hex 380 - 38F inclusive.	

molecular computer
The Supermicro Company™

Supermicro 8™

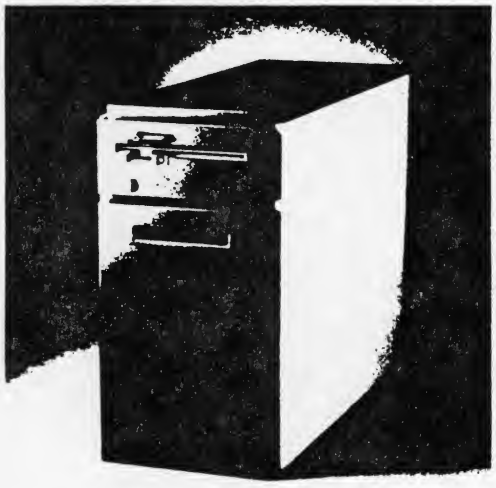
Supermicro 8™ Multiprocessor System

Featuring:

- Multiprocessor architecture
- CP/M® Compatibility
- Expandable from 1 to 8 users
- Dedicated 64K Z80A system for every user
- Powerful File Processor
- 10 MB Winchester disc storage (5¼")
- 500 KB 8" floppy disc drive (3741 compatible)
- n/STAR™ Network Operating System
- High Speed CSMA/CD Interprocessor Bus

Options:

- 20 MB Tape Backup Unit
- Up to 30 MB Winchester disc



Supermicro 8™... an Introduction

The Supermicro 8™ System offers a high performance, low cost entry into the multiple user local network market. The Supermicro 8™ is designed to optimize price/performance while supporting either one user operating stand-alone, or up to eight users performing a variety of simultaneous tasks.

The Supermicro 8™ System is a powerful microprocessor based local networking system designed to support multiple CP/M users. ***It is a multiprocessor system:*** Each user is provided with a dedicated Application Processor, including the Z80A microprocessor and 64K Bytes of RAM for high speed application processing. A Z80A based File Processor, which includes its own 64K Bytes of RAM, controls the disc management and manages other shared peripherals.

Application Processors are linked to each other, and to the File Processor, via a unique high speed bus -- the m/BUS Interprocessor Link. The n/STAR Network Operating System resides in the File Processor, providing each user a CP/M compatible environment, plus a wide variety of enhanced capabilities.

m/BUS Interprocessor Link

The key to the performance of the Supermicro 8™ is the high speed m/BUS Interprocessor Link. This leading edge design supports high speed communication between the independently operating Application Processors and the File Processor. Additionally, the unique protocol of the m/BUS allows ***Application Processors*** to directly communicate with other ***Application Processors without involving the File Processor***. The m/BUS is a contention bus design, using a protocol known as Carrier Sense Multiple Access with Collision Detection (CSMA/CD). This approach eliminates the overhead associated with other network architectures, such as those based on a polling scheme.

n/STAR Network Operating System

The n/STAR Network Operating System provides a variety of features unique to the Molecular Computer multiprocessor networking environment. CP/M compatibility allows existing CP/M based application programs to run in a multiple user environment. Additionally, concurrent file sharing is provided by implementation of the unique record locking features of n/STAR System password security, private and common user files, and print spooling are among the other features provided by the n/STAR Network Operating System.

Network Unit

The Network Unit is a pleasingly designed stand-alone cabinet which has been created to fit the decor of today's modern office. It houses the File Processor, disc controller boards, Winchester disc drive, floppy disc drive, power supply, Application Processor mounting rack, and optional Streamer Tape Backup Unit.

File Processor

The File Processor contains a Z80A microprocessor, 64K Bytes of RAM with parity checking, and the floppy disc controller. The n/STAR Network Operating System resides in the File Processor, using approximately one half of its RAM capacity. The remainder of the RAM is used to provide a 32K Byte disc buffer pool, which greatly enhances the system ***throughput*** in multiple user applications. The File Processor provides two RS232C serial ports, plus one parallel port, designed to support attachment of additional peripherals.

10 Million Character Capacity
The Supermicro 8™ System provides a Winchester disc drive of 10 million character capacity (10 MB). Backup and program transportability is provided by a 500 KB 8" floppy disc drive (IBM 3741 compatible).

Application Processors
Each Application Processor is a 4" by 9" card which is internally mounted in the Network Unit, and connects to the m/BUS Interprocessor Link. Each Application Processor consists of a Z80A microprocessor, 64K Bytes of RAM with parity checking, and 2K EPROM. Additionally, each Application Processor contains two RS232C serial I/O ports, or other custom designed ports required to perform special functions.

Configurations
The minimum Supermicro 8™ configuration consists of the File Processor, 10 MB Winchester disc drive, 8" floppy disc drive, 2 RS232C ports and a parallel port. This can be operated as a stand-alone single user system running under CP/M Version 2.2.

The minimum Supermicro 8™ configuration running under the n/STAR Network Operating System consists of all the features noted above, plus one Application Processor.

Upgrades to the Supermicro 8™ System running under n/STAR are very simple. All that is required is the insertion of an additional Application Processor into the Network Unit. n/STAR ***automatically reconfigures itself*** to recognize the newest user. Every additional user, up to a total of eight, is implemented in the same manner.

Increased Capacity...always available
Up to two additional 10 MB disc drives may be added to the basic configuration, for a total of 30 MB of Winchester disc storage. Additionally, a 20 MB Streamer Tape Drive is available for high speed backup. These upgrades are field installable and are mounted inside the original Network Unit.

The Supermicro Series...a powerful computing family
The Supermicro 8™ Multiprocessor System is the first in the Supermicro Series...a family of powerful, easily upgradable microprocessor based general purpose computers offering all the features, throughput and sophistication of mainframes. It is designed to offer price/performance ratios heretofore unavailable in the small business computing marketplace. Call Molecular Computer for the name of the distributor nearest you!

Supermicro 8™ Specifications

Network Unit

Physical Dimensions	
Length	31.5 in. (80.0 cm)
Width	12.0 in. (30.5 cm)
Height	24.0 in. (61.0 cm)
Weight	145 lbs. (65.8 kg)
Ambient Temp	10 to 30° C
Humidity	10 to 90%
Power Requirements	
Power Consumption	120 VAC/60 Hz (240VAC/50 Hz)
1 User	360 W
8 Users	420 W
File Processor/Memory	
CPU	Z80A
Primary Clock	4 MHz
RAM	
Cycle Time	200 ns Dynamic
Capacity	65,536 Bytes
Parity Checking	Yes
ROM	
Capacity	2048 Bytes
Software Deselect	Yes
Interrupts	Vectored, Priority
I/O	
Serial	Z80 Family Z80A DART SIO [2 channel]
Parallel	Z80A PIO [16 Bit Bidirectional]
DMA	Z80A DMA
Timer	2 Z80A CTC
Floppy Disk Controller Chip	WD 1793 w/dual density data
DC Power Requirements	+ 5V @ 2.0A + 12V @ 0.03A
Physical Dimensions	
Length	10.0 in. (25.4 cm)
Width	8.0 in. (20.3 cm)
Weight	12.5 oz. (0.355 kg)
Ambient Temp.	10 to 30° C
Humidity	10 to 90%

Disk Drives	**Winchester**	**Floppy**
Capacity (formatted)	10.0 MB	0.512 MB
Bytes per sector	256	256
Sectors per track	32	26
Number of cylinders	306	77
Number of heads	4	1
Timing		
Single track positioning	3 ms	3 ms
Average track positioning	100 ms	91 ms
Rotational latency	8.3 ms	83 ms
Transfer Rate	5 Mbits/sec.	500K bits/sec.

CP/M® is a registered trademark of Digital Research.
Specifications are subject to change without notice.

molecular computer
The Supermicro Company™

1841 Zanker Road
San Jose, CA 95112
(408) 995-5440

Electronic Industries Association
RS-232C Interface

PIN NO	CCITT EQUIV	CIRCUIT	DIRECTION	DESCRIPTION	INTERFACE TYPE A	B	C	D	E	F	G	H	I	J	K	L	M	Z
1	101	AA	Both	Protective Ground	-	-	-	-	-	-	-	-	-	-	-	-	-	
7	102	AB	Both	Signal Ground	x	x	x	x	x	x	x	x	x	x	x	x	x	x
2	103	BA	To-m	Transmitted Data	x	x		x	x	x		x		x		x	x	p
3	104	BB	To-T	Received Data			x	x	x		x		x		x	x	x	p
4	105	CA	To-m	Request to Send		x		x		x				x		x		p
5	106	CB	To-T	Clear to Send	x	x		x	x	x		x		x		x	x	p
6	107	CC	To-T	Data Set Ready	x	x	x	x	x	x	x	x	x	x	x	x	x	p
20	108.2	CD	To-m	Data Terminal Ready	d	d	d	d	d	d	d	d	d	d	d	d	d	p
22	125	CE	To-T	Ring Indicator	d	d	d	d	d	d	d	d	d	d	d	d	d	p
8	109	CF	To-T	Received Line Signal Detector			x	x	x		x		x	x	x			
21	110	CG	To-T	Signal Quality Detector														p
23	111	CH/CI	Either	Data Signaling Rate Selector/Indicator														p
24	113	DA	To-m	Transmitter Signal Element Timing (DT DCE)	s	s		s	s	s		s		s	s	s	s	
15	114	DB	To-T															
17	115	DD	To-T	Receiver Signal Element Timing (DCE)			s	s	s		s		s		s	s	s	p
14	118	SBA	To-m	Secondary Transmitted Data							x		x	x	x	x	x	p
16	119	SBB	To-T	Secondary Received Data						x		x		x	x	x	x	p
19	120	SCA	To-m	Secondary Request to Send							x			x	x	x		p
13	121	SCB	To-T	Secondary Clear to Send							x		x	x	x	x	x	p
12	122	SCF	To-T	Secondary Received Line Signal Detector						x		x		x	x	x	x	p

Legend
p To be specified by the supplier
- Optional
d Additional Interchange Circuits required for Switched Service
s Additional Interchange Circuits required for Synchronous Channel
x Basic Interchange Circuits, All Systems
m modem
T term
PIN Number 9 & 10 usually reserved for Modem testing
PIN Numbers 11/18/25 unassigned

Key to Columns:
A Transmit Only
B Transmit Only*
C Receive Only
D Full Duplex* Half Duplex
E Full Duplex
F Primary Channel Transmit Only* Secondary Channel Receive Only
G Primary Channel Receive Only Secondary Channel Transmit Only*
H Primary Channel Transmit Only Secondary Channel Receive Only
I Primary Channel Receive Only Secondary Channel Transmit Only
J Primary Channel Transmit Only* Half-Duplex Secondary Channel
K Primary Channel Receive Only Half-Duplex Secondary Channel
L Full-Duplex Primary Channel* Full-Duplex Secondary Channel* Half-Duplex Primary Channel Half-Duplex Secondary Channel
M Full-Duplex Primary Channel Full-Duplex Secondary Channel
Z Special (Circuits specified by Supplier)

*Indicates the inclusion of Circuit CA (Request to Send) in a One-Way Only (Transmit) or Full-Duplex Configuration where it might ordinarily not be expected, but where it might be used to indicate a nontransmit mode to the data communication equipment to permit it to remove a line signal or to send synchronizing or training signals as required.

Potential RS232-C Problems

RS232-C has many forms of implementation. Manufacturers consider their equipment to be either a DTE or a DCE. With two machines of the same type, crosswiring is required. Check the system's specifications for system definitions.

To attach an RS232-C printer when both the computer and the printer consider themselves terminals wire the following pins:

2:3 7:7
3:2
Jumper 20, 5, and 6

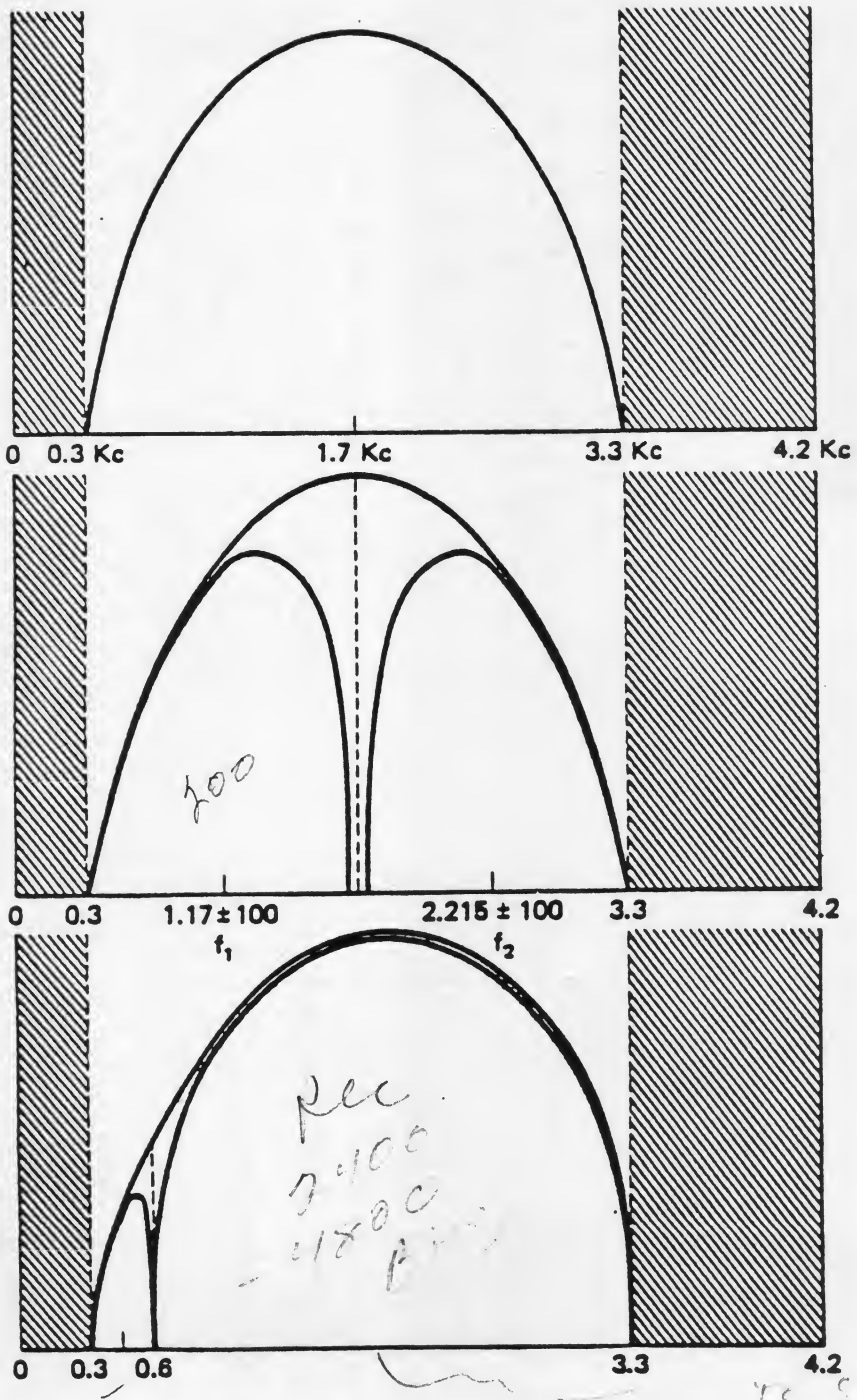
If there is handshaking then attatch the printers 20 to the computers 6 .

Several variations are available, check the system specifications carefully.

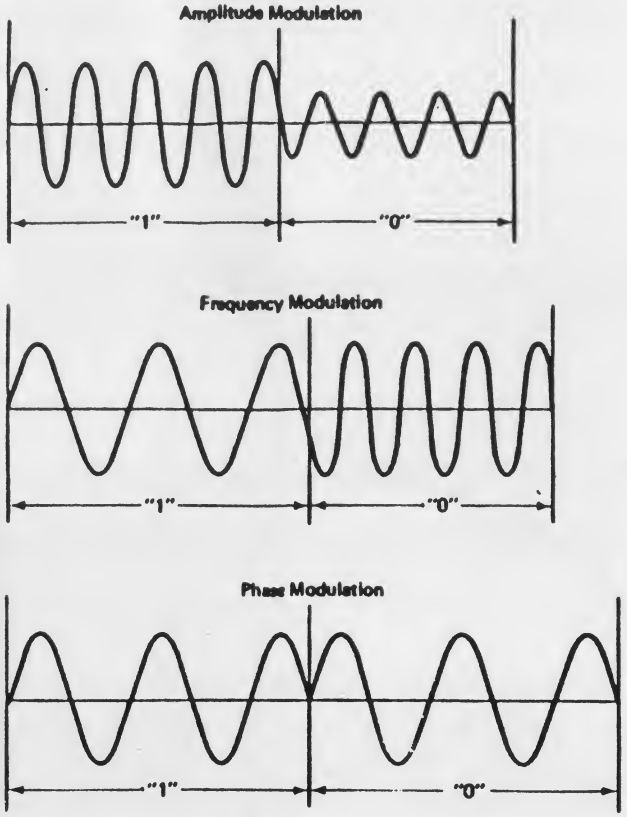
Some equipment is designed not to raise pin 20 (DTR) unless pin 6 (DSR) is on. However, under the RS232-C Standard, DTR must be on before any switched, call-up is initiated on RI (pin 22). This places the interface in a Catch-22 situation; neither DTR nor DSR can come on. Modems should then be wired to answer RI independently of DTR.

RTS (pin 4) is raised when a site wants to transmit. Transmission does not begin until CTS (pin 5) comes on. However, a full duplex, four wire operation has several variations in using RTS, CTS and LSD (Line Signal Detect, pin 8). For Example, a terminal may keep RTS on continuously and simply needs CTS on in order to transmit. This usually presents no problem. However, under a four-wire configuration, some terminals switch RTS on and off between transmissions. In this case, the modem must be wired (strapped) to keep its transmission going when the terminal RTS goes off. Be aware that this situation often requires special timing for the modem to delay raising CTS back to the terminal. Some terminals do not operate properly if the CTS signal goes on immediately. Modems are usually provided with several optional delays (strapped delays for example of 0, 8.5, 50 and 150 ms.)

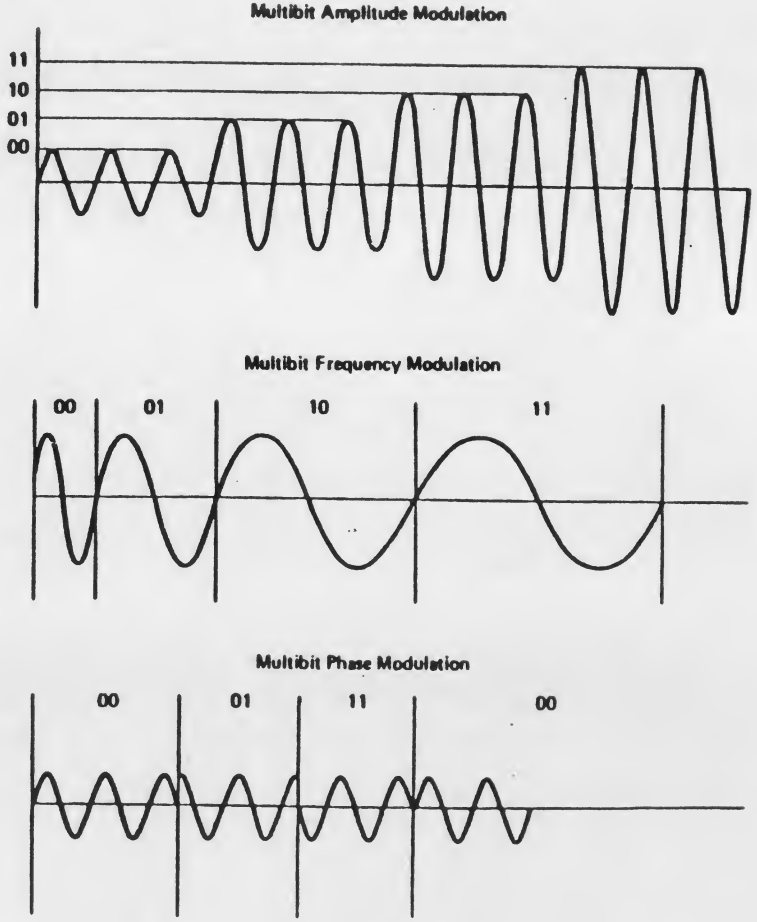
Multidrop, polled lines present several problems. The modems must turn their carrier signal on and off since they share the same line. The switching requires time and the receiving modem must "lock-in" to the carrier signal within a few milliseconds. In the event the equipment does not synchronize properly, a repoll usually occurs, and perhaps a "slow poll" to allow additional time for a circuit problem to pass. If this happens, the network throughput is substantially degraded.



Split Channel and Reverse Channel Modems



Basic Modulation Techniques



Multibit Modulation Schemes

Modem Chart

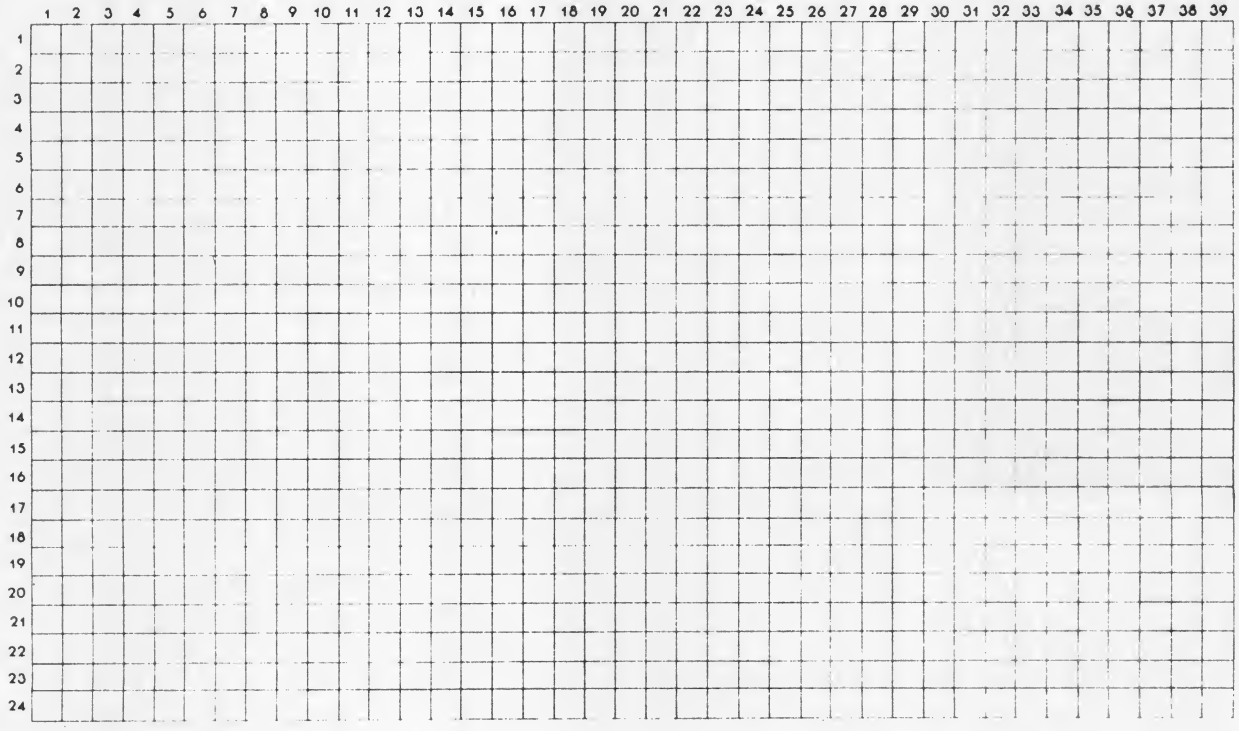
Company	Model	cost	type	speed	mode	Bell
A.M. Jacquard	AM103LP	$195	direct	0-300	O/A	103
A. Jacobson	AJ245	$245	direct	0-450	O	103
Bell Telephone	103AR	rent	direct	0-300	O	103/113
	113CR	rent	direct	0-300	O	103/113
	103DR	rent	direct	0-300	A	103
	103JR	rent	direct	0-300	O/A	103/113
Bizcomp	1084	$299	direct	0-300	O/A	103
Codex	5113	$475	direct	0-300	O/A	103
Comdata	150A2	$127	couple	0-300	O	103/113
Commodore	Vic	$110	direct	0-300	O/A	103
	8010	$280	couple	0-300	O/A	103/113
Hayes	Smart	$279	couple	0-300	O/A	103
	Micro2	$379	direct	0-300	O/A	103
	100	$399	direct	0-300	O/A	103
HP	82950-A	$395	direct	0-300	O/A	103
Novation	Cat	$189	couple	0-300	O/A	103
	Cat	$189	couple	0-300	O	103/113
	D-Cat	$199	direct	0-300	O/A	103/113
	A-Cat	$249	direct	0-300	O/A	103/113
Racal-Vadic	VA103	$250	direct	0-300	O/A	103/113
Radio Shack	ModemII	$249	direct	0-300	O/A	103/113
A.M.Jacquard	AM202LP	$295	direct	0-1800	O/A	202
	AM202S	$515	direct	to1800	O/A	202
	AM212A	$900	direct	to1200	O	103/113/212
Comdata	33E2-22L	$207	direct	1200	O/A	202
	T212A	$837	direct	to1200	O/A	103/212
Hayes	SM1200	$699	direct	to1200	O/A	103/113/202
Novation	4200	$375	direct	to1200	O/A	202
	ApCatII	$389	direct	to1200	O/A	103/212
	212AuCat	$695	direct	to1200	O/A	103-212
	212ApCat	$725	direct	1200	O/A	212
Racal-Vadic	VA1224	$400	direct	1200	O/A	202
	1250	$425	direct	1200	O/A	202
	VA1251	$525	direct	1200	O/A	202
Radio Shack	DC1200	$699	direct	to1200	O/A	103/113/202

BELL DATA SETS

Bell Data-Phone Data Sets

TYPE	SPEED	LINE
103A	Up to 300 bps Transmit or Receive	Direct Distance Dial
103F	Up to 300 bps Transmit or Receive	Private Line
113A	Up to 300 bps Orig. Only	Direct Distance Dial
113B	Up to 300 bps Auto Ans. Only	Private Line
201A	2000 bps Transmit or Rec.	Direct Distance Dial
201B	2400 bps Transmit or Rec.	Private Line
202C	1200 bps Transmit or Rec.	DDD & Private Line Includes Telephone
202D	1800 bps Transmit or Rec.	Private Line
202E	600 bps Transmit, with 5 bps Receive	Telephone Powered
202G2	600 bps with 5 bps Rev. Channel Transmit or Rec.	Acoustic Coupled
203A	1800 bps with 150 bps Rev. Channel Transmit and Rec.	Private Line
203B	2400 bps with 150 bps Rev. Channel Transmit or Rec.	Private Line
203C	3600 bps with 150 bps Rev. Channel Transmit or Rec.	Private Line
205C2	1200/2400 bps Transmit or Receive	DDD & Private Line
207	150/300/600/1200 bps Transmit or Receive	DDD & Private Line
208A	4800/5400/7200 bps Transmit or Receive	Private Line with C-2 Conditioning
209	9600 bps Transmit or Rec.	Private Line with D-1 Conditioning
301B	40.8 kbps FDX	Basegroup Channel
303B	19.2 kbps FDX	Halfgroup Channel
303C	50 kbps FDX	Basegroup Channel
303D	230.4 kbps FDX	Supergroup Channel
401A	Up to 20 cps Transmit 2-out-of-8 code	DDD & Private Line
401B	Up to 20 cps Receive 2-out-of-8 code	DDD & Private Line
401E	Up to 20 cps Transmit 3-out-of-14 code	DDD & Private Line
401H	20 cps & 200 bps Transmit	DDD & Private Line
401J	20 cps Receive	DDD & Private Line
402A	75 cps Transmit 8-bit parallel code	DDD & Private Line
402C	75 cps Transmit with Reverse Channel	DDD & Private Line
402D	75 cps Receive with Reverse Channel	DDD & Private Line
403A	10 cps Transmit	Touchtone Telephone
403B	10 cps Transmit	Touchtone Telephone
403C	10 cps Transmit	Touchtone Telephone
601A	Handwriting	DDD & Private Line
601B	Handwriting	DDD & Private Line
602C	Facsimile & Slow Scan Television	DDD & Private Line
603A	EKG Transmit	DDD & Private Line
603B	EKG Receive	DDD & Private Line
603D	EKG Portable	DDD & Private Line
801A	Dial Pulse Automatic Calling Unit	DDD
801C	Touchtone Automatic Calling Unit	DDD

D B MASTER SCREEN FORM LAYOUT SHEET



FILE NAME ———————————————————— PAGE # ————————————————

EACH FIELD HAS 2 LENGTHS ASSOCIATED WITH IT: 1. # OF CHARACTERS IN FIELD
2. MAX. # OF SPACES IT CAN OCCUPY ON SCREEN, INCLUDING $, —, (Y/N), ETC.

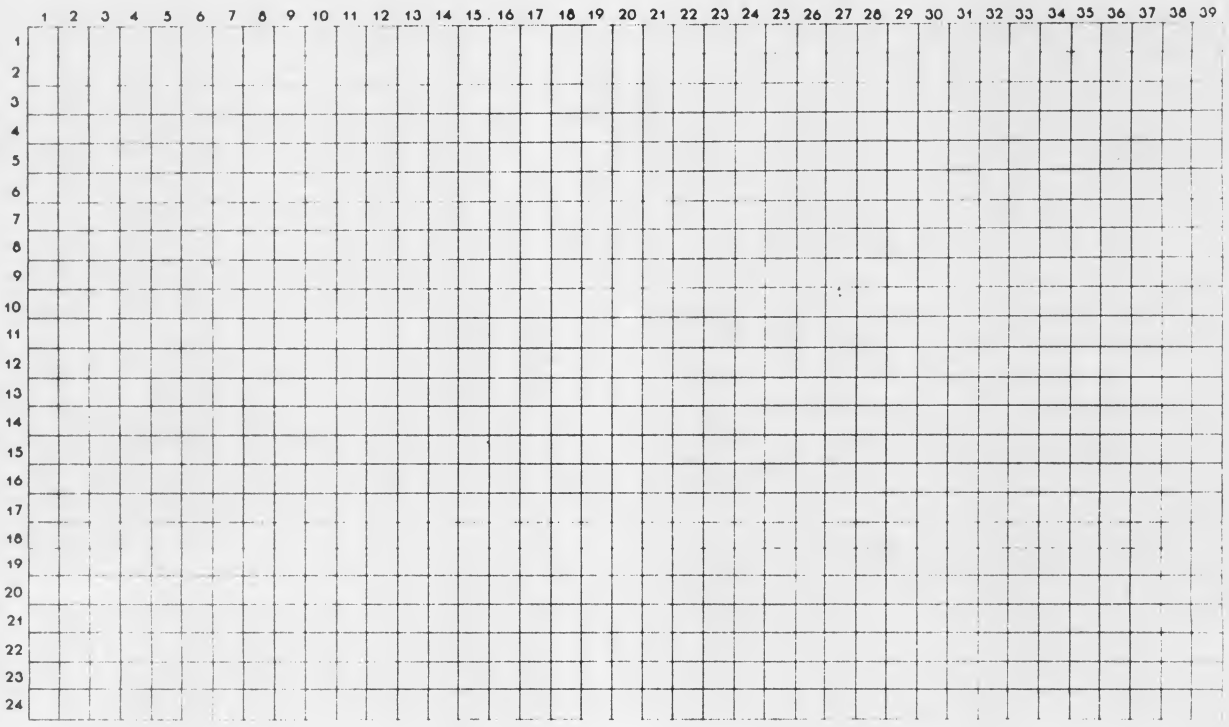
USE 2ND (GREATER) LENGTH IN DESIGNING YOUR FORM ABOVE. NOTE 1ST (SHORTER) FIGURE AT EACH FIELD TO REMIND YOU OF LENGTH TO ENTER INTO COMPUTER.

TO DETERMINE 2ND LENGTH, USE THE FOLLOWING RULES:

FIELD TYPE	# TO ADD TO 1ST LEN.	MINIMUM 2ND LENGTH	MAXIMUM 2ND LENGTH
ALPHANUMERIC	3	4	33
0 - 255	3	4	6
+ / — 32767	3	4	9
FLOATING POINT	3	4	11
DOLLAR / CENTS	4	8	15
YES / NO		2ND LENGTH = 9	
SOCIAL SECURITY		2ND LENGTH = 14	
TELEPHONE NUMBER		2ND LENGTH = 15	
DATE & AUTO DATE		2ND LENGTH = 11	

DO NOT USE LINES 1, 23 OR 24. DO NOT GO BEYOND CHARACTER POSITION #39.

D B MASTER SCREEN FORM LAYOUT SHEET



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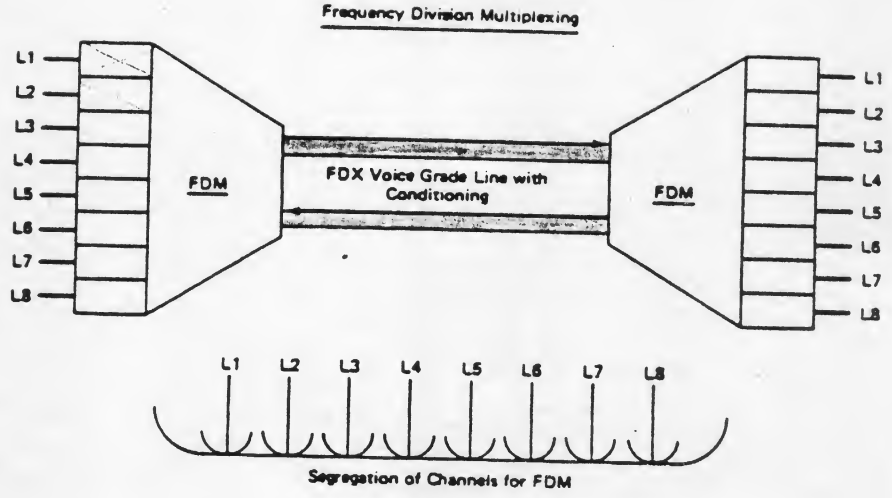
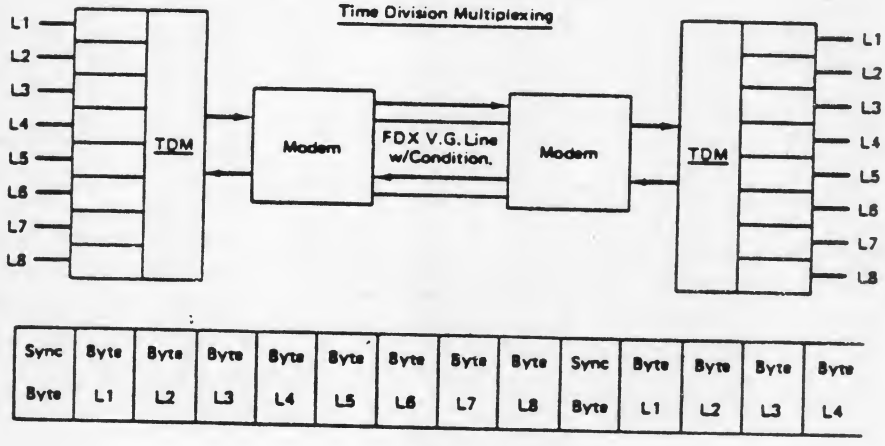
YES / NO		2ND LENGTH = 9	
SOCIAL SECURITY		2ND LENGTH = 14	
TELEPHONE NUMBER		2ND LENGTH = 15	
DATE & AUTO DATE		2ND LENGTH = 11	

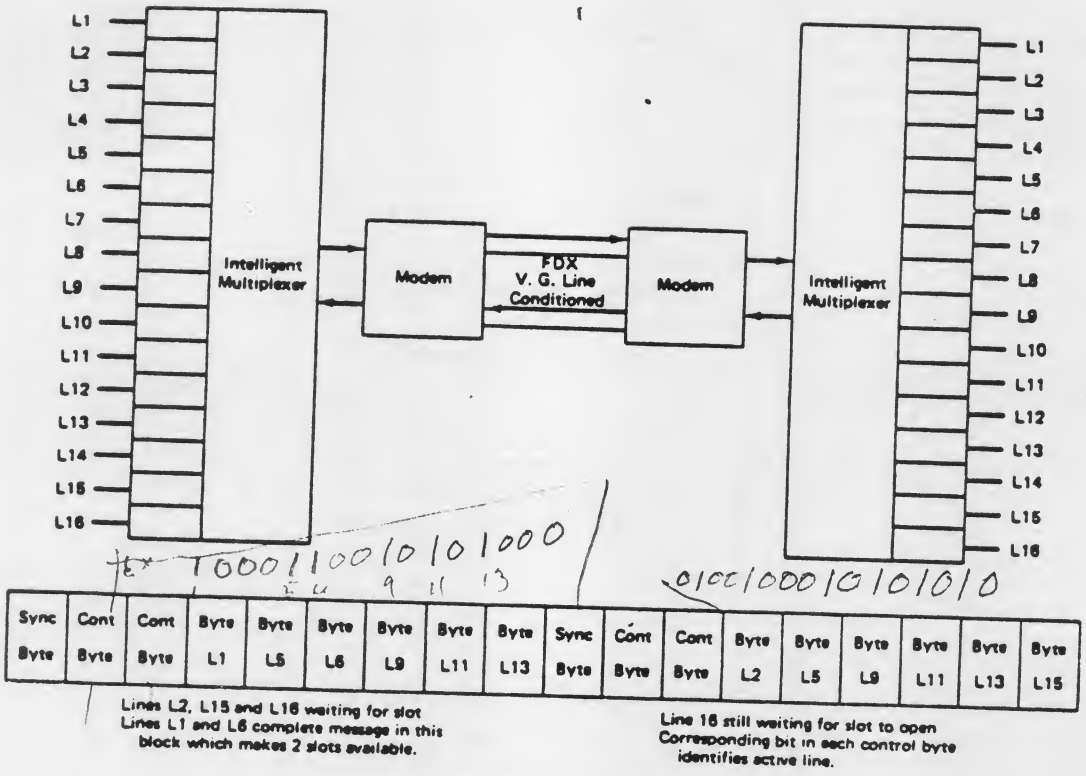
DO NOT USE LINES 1, 23 OR 24. DO NOT GO BEYOND CHARACTER POSITION #39.

Early Com Methods





Multiplexing Techniques

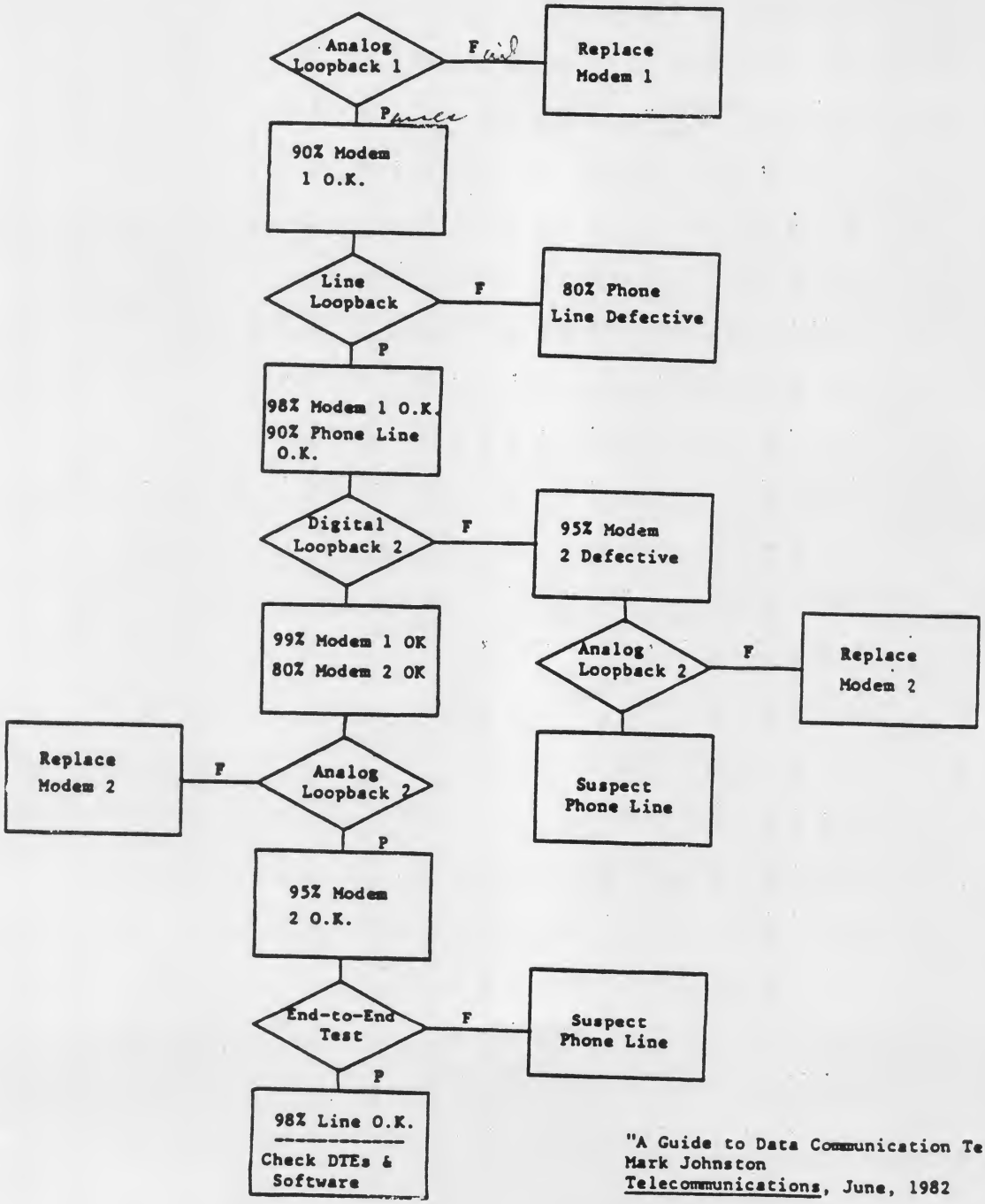


Intelligent/Statistical Multiplexing

Communications Software Functions

Async Terminal
Host Mode
Half and Full Duplex
Stop Bit Adjustment
Parity Bit Selection
Adjust Carriage Returns
Delay Timing
Set Baud Rate (Automatic)
Dial Numbers
Auto Answer/Auto Dial
ASCII Capture
Print Transaction
Save Transaction Log
View Log
File Directory
View File
Delete File
Send and Receive Files
Batch Transmission Mode
Error Checking
Non-ASCII Files
Synchronous Protocol

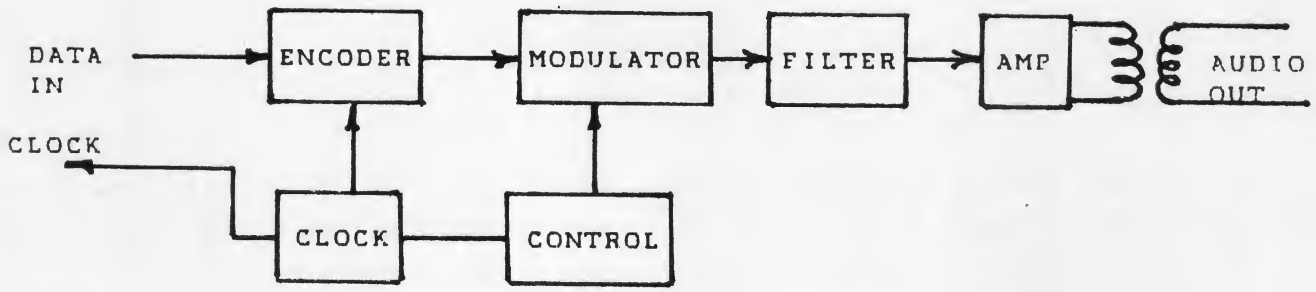
Line and Modem Testing



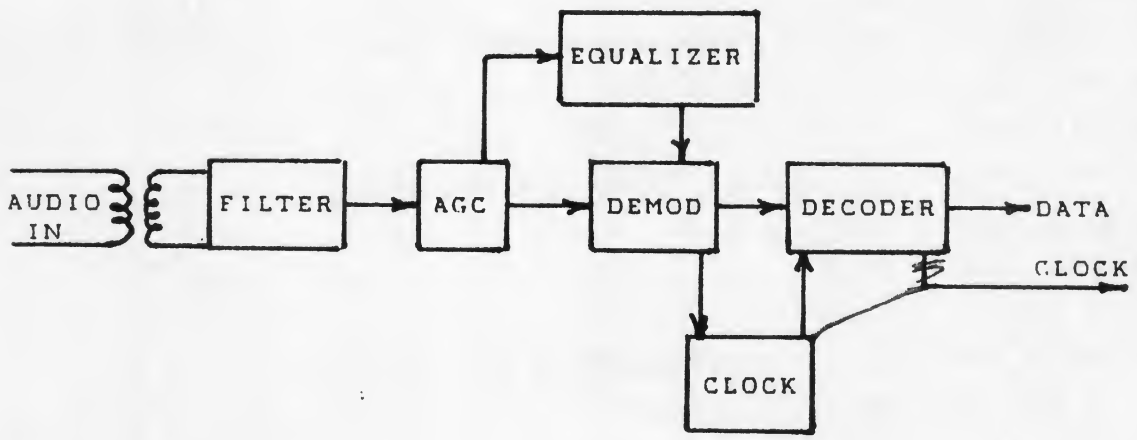
"A Guide to Data Communication Testing"
Mark Johnston
Telecommunications, June, 1982

Synchronous Modems

Transmitter



Receiver



Data Encoder- Determines carrier modulation changes
Modulater - Changes carrier frequency, phase or amplitude
Filter - Shapes frequency to the phone line
Line Amp - To match the impedance of the phone line
Equalizer - Compensates for line distortion at >2400 bps
Data Decoder- Puts out serial signal
Clock - Generates timing pulses

Dial up vs. Leased Lines

DIAL UP - Contention Protocol

SPEED LIMITATION - ASYNC 1200 bps 2 wire full duplex
LINE ERRORS - Higher at 2400 bps and beyond
TURN AROUND TIME - Can Reduce Throughput
SMRT IS COMING - Single Message Unit Rate Timing

LEASED LINES - To 14.4Kbps, 9600 most common

PERMANENT CONNECTION - With one or more terminals
FULL DUPLEX - About 10% more than Half Duplex
SPECIAL PHONE REQUIREMENTS - Voice/Data
CONDITIONING - FCC Tariff 260
INTERSTATE LESS COSTLY THAN INTRASTATE
JACKS - RJ11C vs. RJ45S

UNLOADED LINES - (19.2Kbps) 15% 3002 Line
Comm sites in the same class 5 office
Twisted Wire Pair
Limited Distance Modem, Line Driver

DDS - High Speed up to 1.5 Mbps
most common 2400-56 Kbps
303 Wideband up to .2Mbps

LINE COSTS

Dial up	$25/mo. each end (SMRT)
Local Leased Lines	$3 - $15 per mile
AT&T Leased Lines	$.50 - $2.55 per mile
Unloaded Lines	$.50 - $1.00 per mile (no min)
Data Phone Digital	3-15% more than leased
303 Wide Band	lines with Bell Modems

DISTANCE	MONTHLY RATE	COST/MILE
1	$ 72.39	$72.39
15	$ 105.44	$ 7.53
100	$ 244.64	$ 2.45
1000	$1085.64	$ 1.09

MODEMS

SPEED	BELL EQ.	TYPE	MODE	RENTAL	PURCHASE
300	103/113	ASYNC	FDX	$15-25	$200
1200	202	ASYNC	HDX	$25-35	$400
1200	212	SYNC	FDX	$35-45	$700
2400	201	SYNC	HDX	$65	$750
4800	208	SYNC	HDX	$110	$2000
9600	209	SYNC	FDX	$220	$3000

. . . harness the Microcomputer Explosion under Data Processing's control and show management how to make microcomputers more productive!"

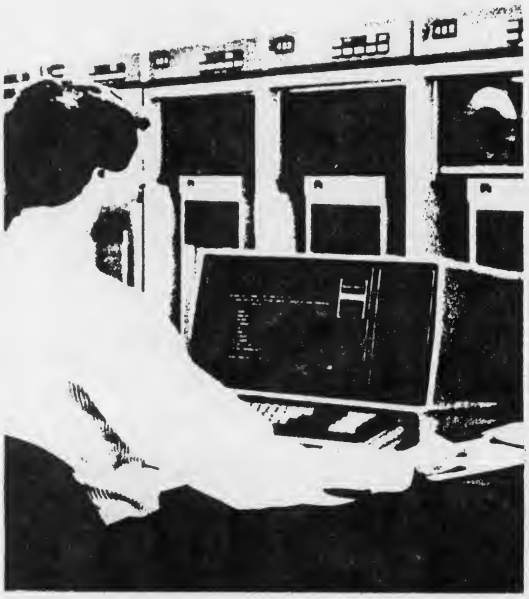
"The proliferation of microcomputers is a fact of modern business and regardless of what many data processing professionals think, microcomputers will start appearing in all companies sooner or later! For the most part, it's been "sooner" simply because microcomputers are the key to increased productivity and department managers are bypassing their data processing departments in purchasing various and assorted microcomputers to obtain this competitive edge.

In some companies, different departments have bought different brands of microcomputers without any thought to compatibility.

Still, sooner or later, the one thing that these department managers have in common is that they will want to access information files available only on data processing's mainframes... and that's where the problems start!

Before that happens, you need to take control and recommend to your management the complete microcomputer system capable of handling and growing with your company's needs... a system that communicates with your mainframes... a system that is totally backed by service and support!

Even if Radio Shack was not in the microcomputer business and the TRS-80 Model II still existed, I would consider it the logical choice for data processing professionals to build on for their company for three very important reasons:



1. The TRS-80 Model II is compatible with your IBM mainframes through these TRS-80® communications software packages:

Binary Synchronous Communications 3270

This program lets your TRS-80 Model II emulate an IBM 3270/3271/3275/3277 display station.

The Model II can communicate through a modem and telephone line to a remote computer, using standard IBM Binary Synchronous Communications (BSC) protocol for the IBM 3271 or 3275. Such remote computers include IBM Systems 360/370 and 30-series Central Processing Units, plus non-IBM devices equipped with BSC-3270 communications capability.

All functions of an IBM 3270 display station are provided for, including screen formatting, polling responses, data link control, time out control, and cyclic redundancy checking.

A TRS-80 Model II equipped with the Bisync-3270 program may be used interactively with systems such as IBM's CICS, VM/CMS and IMS, plus with other remote systems that support IBM 3271 or 3275 terminals.

Bisync 3270 communicates in half-duplex mode and may operate at data rates up to 19,200-baud depending on the type of communications connection used.

IBM/DEC® Compatible Binary Synchronous Communications 3780

With this communications program, your TRS-80 Model II can function as an IBM-compatible remote terminal or a Remote Job Entry (RJE) terminal connected to a mainframe computer by telephone.

Bisync-3780 allows the selection of IBM 2770, 2780, 3741, or 3780 terminal protocols for communicating with the IBM Systems 360/370 and 30-series computers, IBM 2780 and 3780 terminals, DEC PDP-11 or VAX-11 computers, and other devices equipped with bisynchronous communications ability.

Commands and options are provided which permit you to: send one or a series of files to a remote, receive data from the remote onto a printer or disk files, automatically convert between EBCDIC and ASCII codes, transmit or receive character coded data in transparent or non-transparent modes, automatically pad or truncate records to match transmitted data to required protocol, and decode printer forms-control commands.

Bisync-3780 communicates in half-duplex mode and may operate at data rates up to 19,200-baud depending on the type of communications connection used.

ReformaTTer™

New programs and data for use with IBM equipment can be prepared using the TRS-80 Model II.

MITE

THE SMALL VOICE HEARD AROUND THE WORLD

MITE is **the** State Of The Art intelligent terminal and file transfer utility for CP/M. It is menu oriented, supports multiple protocols (MITE, XMODEM, CLINK, HAYES, etc.), and is available pre-installed (with *full* dynamic modem control in *all* versions) on a wide variety of systems. It is ideal for accessing virtually any asynchronous ASCII online system (e.g. the Source, Compuserve, many university computer systems), or for exchanging any CP/M file with a large number of other microcomputers, with error checking and recovery. Programmable macro strings are available, including support for fully automatic login on most systems. Auto-dial and auto-answer are supported (if present in hardware). Multi-file transfers (e.g. *.ASM) and remote command capability are now included.

There are several menus, which group the communications functions such that a novice user can ignore the more sophisticated features until they are ready for them. The Main Menu allows you to load or save the communications parameters (phone number, baud rate, parity, macro strings, etc.), initiate a call, await incoming call(s), or branch to one of the other menus. Once the link has been initiated, it is possible to invoke the Main Menu with a single (user defined) keystroke. Each menu option is selected by a single (mnemonic) character (e.g. P to go to the Parameter Menu). It is possible to return to the Main Menu from any of the other menus with the X option.

The other menus are:

Parameter — Parity, Baud Rate, Phone #, etc.
Option — Trigger Characters, ANS/ORG, etc.
Text File Upload — Start upload, timing/handshaking
Text File Download — Capture on/off, Flow Control, etc.
Binary File Transfer — Select Protocol, Send, Receive
Macro String Definition — Check/define macro strings
System Command Processor — DIR, ERA, REN, space available, etc.

The protocols currently supported include:

XMODEM — RCPM systems, MODEM7, XMODEM, MODEM80, etc.
CLINK — CLINK, CROSSTALK, etc.
HAYES — HAYES Terminal Program
IBMPC — IBM Async Support Package

MITE has been carefully engineered to allow the user to recover from virtually any error they may make, and to insure compatibility with as wide a variety of remote systems and data communications hardware as is possible. Anytime a file is created, the user is warned if there is already a file of that name, and allows them to abort that command. If they try to exit to CP/M with a capture still in progress, that file will be closed automatically to prevent loss of data. When they exit to CP/M, if a carrier is present, they are informed of this fact and given the option of disconnecting.

The only device dependent code in **MITE** is a module called a Communications Input Output System (CIOS), that is similar in nature to a CP/M BIOS. It is included in source form with **MITE**, and has a jump vector at the beginning with several short subroutines that do various simple tasks, such as "set parity", or "check for carrier". Transporting **MITE** to new hardware involves writing a new CIOS, or modifying an existing one. This may be done with quite simple tools, such as ED and ASM. There is also an INSTALL program to select the console terminal type and load the HEX object file of the proper CIOS.

Four Mycroft Labs utilities are included with **MITE:**

TRSCPM — Convert TRSDOS text file(s) to CP/M format
COMHEX — Convert .COM file to Intel .HEX object format
E — Line numbered text editor for novice users
MFT — Multiple File Transfer for single drive systems

Dick Greenlaw's public domain text file compression utilities (SQ, USQ, TYPESQ, FLS) are included (with permission of the author) on the distribution disk, to save each user from having to download them before being able to make full use of the RCPM (Remote CP/M) systems around the country.

The manual is comprehensive and clearly written. It has detailed descriptions of each menu, typical procedures (creating a parameter file, etc.), and several tutorials (Introduction to Data Communications, RS-232 Interfacing, etc.).

Pre-installed versions are currently available for:

S100/Hayes Micromodem 100
Xerox 820
Sanyo 1000, 1200
Kay Comp II
Toshiba 100, 250
Intertec Superbrain
Apple II/Z80/Hayes MM II
Eagle II
S100/PMMI MM-103
Televideo TS-802
Heath/Zenith 89/90
Osborne I
North Star Advantage
Radio Shack M-II with CP/M
Apple II/Z80/Apple Cat
Exxon 500

The list price of **MITE** is **$150.00**. Dealer and distributor enquiries are welcome. For further information, please contact:

MYCROFT LABS INC
Post Office Box 6045
Tallahassee, FL 32301
(904) 385-2708

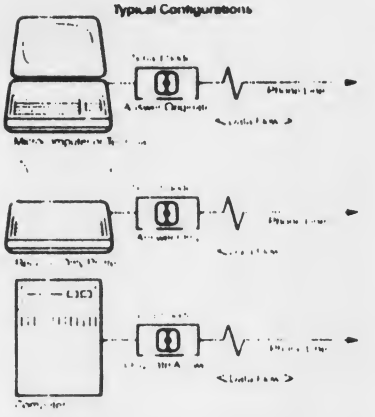
Source ID: TCM495

CP/M is a trademark of Digital Research.
MODEM80 is a trademark of The Alternate Source.
CROSSTALK is a trademark of Microstuf

Hayes Stack™ Smartmodem

High-Performance Data Communications System for Small Computers

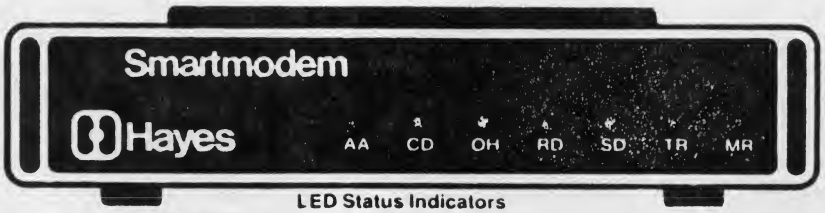
Typical Configurations



Specifications (See Owner's Manual for Complete Specifications)

Operation:	Auto-Answer, Auto-Dial, Full or Half-Duplex, Loop-Back
Data Format:	Serial, binary, asynchronous 7 or 8 data bits, 1 or 2 stop bits odd, even or no parity.
Data Rate:	0-300 baud
Interface:	RS-232C
Intelligence:	Z8 ® microprocessor with 2K byte control program
Modem Compatibility:	Bell System 103 compatible originate or answer mode
Receive Sensitivity:	50dBm
Transmit Level:	10dBm
Dialing Capability:	Touch-Tone™ and rotary dial pulse dialing
Commands:	**A/:** Repeat last command **A:** Immediate answer **C:** Transmitter Carrier **D:** Dial command, including simple dialing, waiting for second dial tone, autodialing and other features **E:** Local echo **F:** Full half duplex **H:** Switch hook **M:** Audio monitor **O:** On line **P:** Pulse dialing **Q:** Quiet mode **R:** Reverse originate answer. **S:** 17 "Set" commands allow user to select various operational parameters, such as dialing speed, escape code character, number of rings to answer on, etc **S?:** Checks operational parameters above **T:** Touch Tone™ dialing **V:** Verbose or decimal digit result codes
Command Buffer:	40 characters
Result Codes:	(can be numerical verbose) **0/OK:** Command line ok **1/Connect:** Carrier detected **2/Ring:** Phone is ringing **3/No Carrier:** Carrier lost or never heard **4/Error:** Error in command line.
Audio Monitor:	Two-inch speaker with volume control
Rear Panel:	On-off switch, power jack, RS-232C connector, modular phone jack connector, monitor volume control
Power Pack:	UL Listed 120VAC, 60Hz 13.5VAC output
Size:	1.5" x 5.5" x 9.6"

FCC Registered for direct connect to the nationwide phone system. Connects with modular jacks RJ11W, RJ11C, RJ12W, RJ12C, RJ13W, RJ13C



LED Status Indicators

(AA) Auto Answer
(CD) Carrier Detect
(OH) Off Hook
(RD) Receive Data
(SD) Send Data
(TR) Terminal Ready
(MR) Modem Ready

Hayes **Hayes Microcomputer Products Inc.** 5835 Peachtree Corners East, Norcross, Georgia 30092

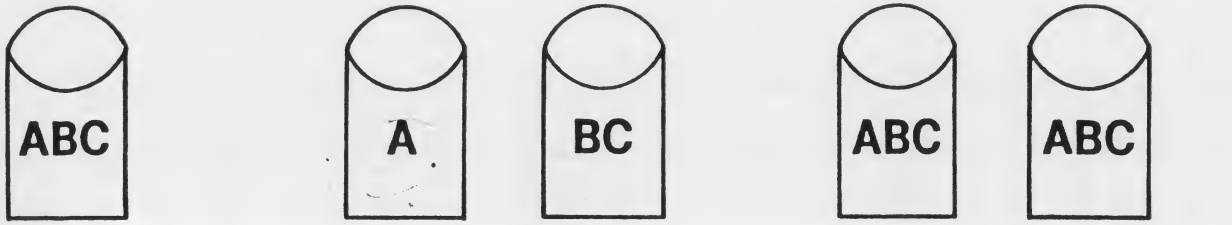
Section 9

Networking

Distributed Processing

- Network of Processing Elements(PE s)
- PEs located away from Central Site
- Processing Organized on a Fuctional or Geographic Basis
- Interconnection of Elements need not be by Common Carrier
- Data may be Dispersed
- Control Mechanisms Exist

Types of Distribution



Distributed Data Trade-Off Decisions

Multiple Copies Issue

One

+ Simple
+ Easy control

Many

+ Retrieval response time
+ Communications costs
+ Fewer bottlenecks

– Potential bottlenecks
– Communications costs
– Response time

– Overhead
– Complexity

Distributed Data Trade-Off Decisions

Partitioned Copies Issue

One

+ Simple
+ Easy control

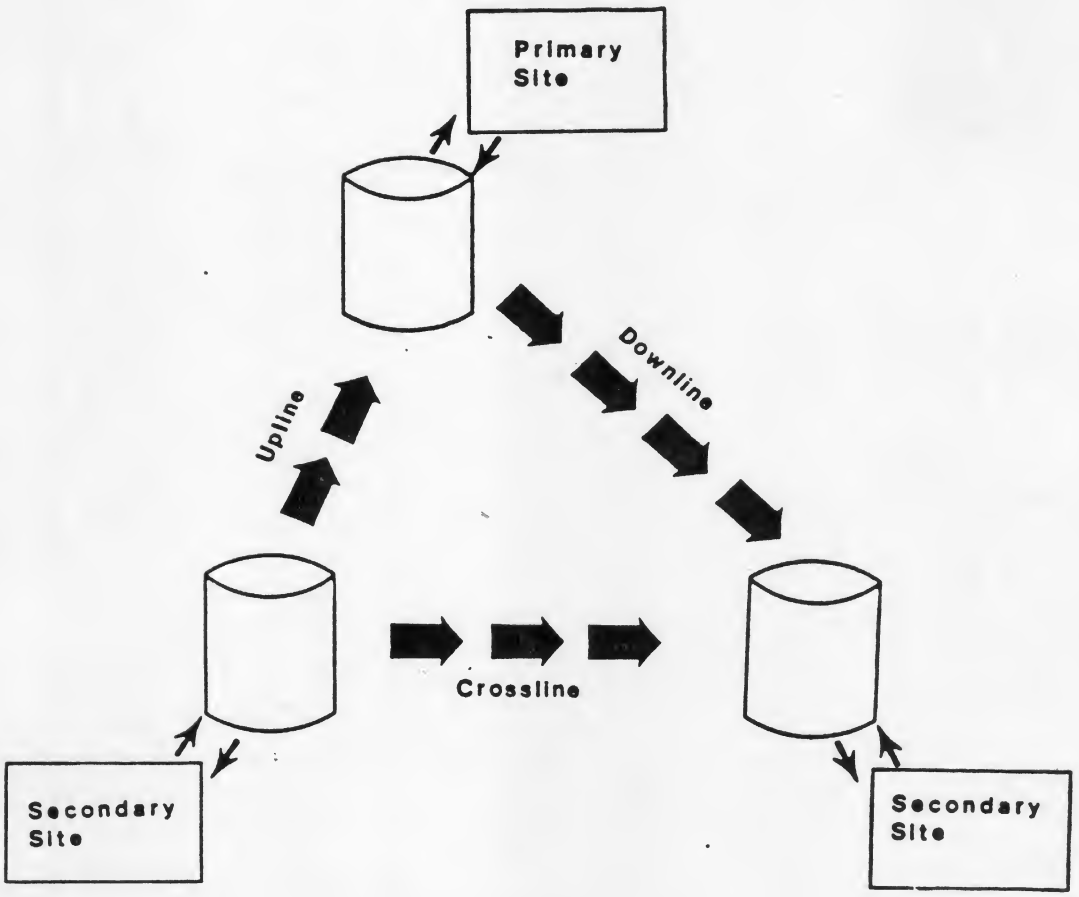
Many Partitions

+ Simplified updates
+ Load leveling
+ Communications costs

– Potential bottlenecks
– Communications costs
– Response time

– Retrieval overhead
– Retrieval delay

OFFLOADING


Primary Site
Downline
Upline
Crossline
Secondary Site
Secondary Site

Section 10

Networks

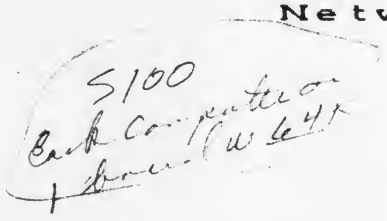
Networking Options

Single Processor

Operating System Control
- o Multiuser

Multiple Processor

Network Control
- o Telecommunications
- o I/O Bus
- o LAN in a Box



Multiple Networks

Gateway Functions
Communications Controllers

Multiuser P.C.'s

- Number of Users
- Available Memory
- Dynamic Memory Allocation
- Centralized Control
- Lowest Cost
- Terminal Rates
- Slow Response
- Application Dependent
- Point to Point

Telecommunications

- Analog Media
- Bandwidth
- Require Modems
- Tariffs
- 17 Second Connect
- Twisted Pair
- Signal Quality
- Data Rates
- Connect Cost

I/O Bus

- Parallel Transfer
- Short Distance
- Expensive Cable
- Machine Dependent
- Fixed Message Size
- High Data Rates
- Intra System

LAN in a Box

- Multiple Processors
- Terminal Rates
- Disk Sharing
- Printer Sharing
- I/O Bound

LAN Definitions

- Limited Geography
- Single Organizations
- Low Cost Media — Serial
- Distributed Communications
- Device Sharing
- No Critical Nodes
- No Common Carrier Links
- Easily Expandable
- Simple to Configure
- High Reliability
- Multiple Network Connectivity
- Supports Multiple Devices
- Low Cost Per Connection
- High Data Rates
- Data Packets
- Error Checking

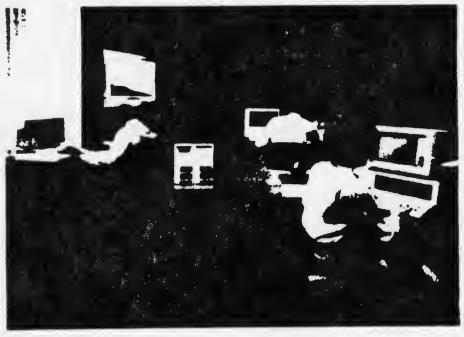
Network Capacity

Bandwidth

Network Data Rate

Throughput

Interface Data Rate



NETWORK TECHNOLOGY

The PLAN 4000™ system incorporates Nestar's field proven network software with a blend of popular, local area network technologies permitting a high speed transmission rate of 2.5 megabits per second. This token passing protocol conforms to the International Standards Organization's seven layers of network architecture.

Stations Supported

The PLAN 4000 system currently supports three of the most popular business oriented personal computers — the IBM®PC, the Apple® II and the Apple III. All three workstations can communicate with each other by various means including electronic mail. Each network segment will support up to 255 stations. These stations can be any mixture of server and user workstations. Even larger networks may be constructed by connecting network segments together using bridges or gateways.

Topology

The Nestar PLAN 4000 system supports an arbitrary topology without loops. Since the stations are assigned unique addresses, they may be connected in an arbitrary manner regardless of their physical location. There can be only one unique path between two stations. With this topology, a network can accommodate a great variety of situations including different floors in the same building or different buildings clustered together.

A LID™ is the device through which a group of workstations connect to the network. This connection is made via coaxial cable which runs between each workstation and its associated LID. The functions of the LID are to electrically isolate the workstation from the network and to minimize the amount of cable running between groups of workstations. In the simplest configuration, there is one LID and all stations connect directly to it.

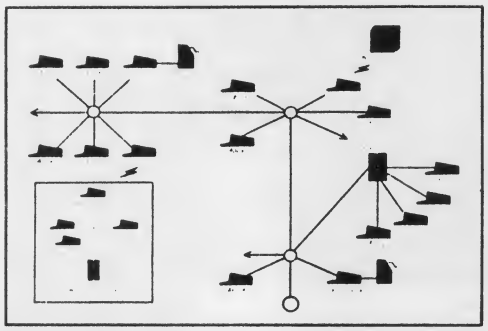
The maximum cable distance permitted between any two stations is over 4 miles (22,000 feet). This connection would require 10 intervening LIDs. The maximum distance between a LID and a workstation or between any two LIDs is 2,000 feet.

Workstation Connection to Network

Coaxial cable is used as the connection medium. Each station is connected to the network via a Network Interface Card that plugs into a slot in the workstation. The cabling, LIDs and the Network Interface Card comprise the logical and electrical interface between user workstations and the File Server. The Network Interface Cards transmit a baseband signal.

Access Scheme

Access to the network is controlled by a token passing protocol whereby a station cannot transmit unless it has possession of the "token". The token is passed from one station to the next higher address station in a "logical" ring, regardless of its physical location. This results in a contention free network since a station must be in possession of the token before it can transmit.



Typical PLAN 4000 Network Configuration

SERVERS

Nestar believes in a "systems" approach to networking. Not only should the hardware be supplied, but so must the software that provides functionality to the system. In addition to the File Server, the PLAN 4000 system offers a Print Server, a File Transfer Server, a 3270 Emulator Server, a 3780 Emulator Server, a Gateway Server and a Telex Server.

File Server

This is a key component of the PLAN 4000 system. Its combination of software and hardware manages user access to shared mass storage and system back-up. Disk storage is available in 60 and 137 megabyte formatted capacity drives to a maximum of 548 megabytes (4 drives) per File Server. A high speed tape back-up unit with 20 or 45 megabyte streaming cartridge tape capacities is built into the File Server cabinet. The File Server software incorporates security features for protection of shared data and programs.

Print Server

The Print Server gives users the capability of "queueing" a request to print a file on a shared printer. By means of a simple menu, users can control format, number of copies, priority, specific printer or specific print server.

The File Transfer Server

FTS is an advanced communication sub-system which enables users of the network to exchange files, programs and messages with other Nestar networks or remote standalone stations having appropriate hardware and software.

3270 Emulator Server

By allowing each workstation to function as display stations, users can directly interface to IBM mainframes that support 3270 bisync protocols. Features emulated by the Nestar software include function keys, protected/unprotected fields, cursor select function and others. Screens may be written to a UCSD p-System text file or printed on a shared printer.

3780 Emulator Server

This Emulator Server gives PLAN 4000 users the capability of exchanging programs and or data with mainframes and minicomputers that support the 3780 bisync protocols.

Gateway Server

The Gateway Server permits real-time access to other networks. Multiple networks, locally interconnected, can directly access each others' facilities.

TELEX Server

Used in conjunction with the MESSENGER™ Nestar's electronic mail program, this server allows users to conveniently communicate messages to TELEX/TWX stations throughout the world from their personal workstations.

ELECTRONIC MAIL

The MESSENGER is an application program that allows a user to "send" messages electronically to other users on the network. Electronic mail functions include answer, forward, file, display, print and send. Nestar server software has been integrated with the MESSENGER to produce a highly functional electronic mail system with remote communication capabilities.

OPERATING SYSTEM SUPPORT

The personal computers compatible with the PLAN 4000 system support popular operating systems. The IBM PC user has available PC DOS or UCSD P-system, the Apple II user may choose DOS, Apple Pascal System or CP/M,® the Apple //e user may run SOS. Users may change environments at will while working at a given station.

SERVICE

Like all Nestar products, the PLAN 4000 is backed by full field service. Support includes Nestar headquarters and regional support centers and third party organizations (dealers, OEMs and RCA Service Company). In addition, product support in Europe is handled by Zynar Ltd.

INTERLAN

3 Lyberty Way
Westford, MA 01886
(617) 692-3900
Telex 95-1909

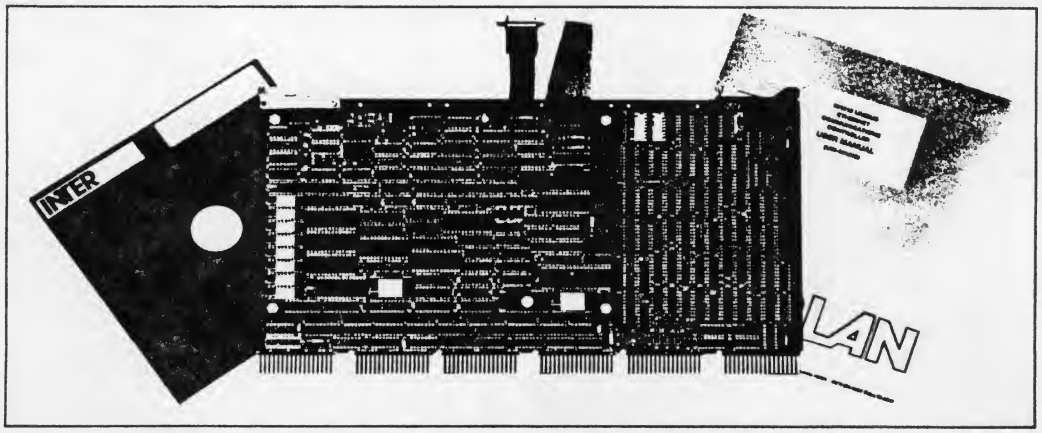
NI1010 Unibus™ Ethernet™ Communications Controller

FEATURES

- **Implements Ethernet Version 1.0 Specifications**
- **Performs Ethernet Data Link Layer Functions:**
  - — Data Encapsulation/Decapsulation
  - — CSMA/CD Transmit and Receive Data Link Management
- **Performs Ethernet Physical Channel Functions:**
  - — 10 MBits Per Second Data Rate
  - — Data Encoding and Decoding
  - — Channel Access
  - — Transceiver Cable Interface
- **Collects Network Statistics:**
  - — Tallies Number of Transmissions, Receptions, Errors, and Collisions
- **Supports High Station Performance:**
  - — 16 KByte FIFO Buffer For Back-To-Back Frame Reception
  - — 2 KByte FIFO Buffer For Frame Transmission
  - — DMA Transfers To/From Unibus Memory
- **Extensive Diagnostic Features:**
  - — Internal and External Data Loop-Back Operation
  - — Network LED Indicators
  - — Power-Up Confidence Test
  - — Pass/Fail LED Indicator
  - — Diagnostic Software Provided
- **One Hex-Height Board**
  - — Fits One Unibus SPC Slot
- **Network Software Support Available**

DESCRIPTION

The NI1010 Unibus Ethernet Communication Controller Board is a single Hex-height board that contains all the data communications controller logic required for interfacing DEC's™ family of VAX-11™ and Unibus-based PDP-11™ minicomputers to the Ethernet local area network. Incorporating the Interlan NM10 Ethernet Protocol Module, the NI1010 board complies in full with the Xerox/Intel/DEC Ethernet V1.0 Specification. It performs the specified data link and physical channel functions, permitting Unibus-based systems to engage in high speed transmission and reception of data with other Ethernet stations on the local area network.



TM Ethernet is a trademark of Xerox Corporation; Unibus, VAX-11, PDP-11, and DEC are trademarks of Digital Equipment Corporation

The information contained herein is believed to be accurate and reliable, however, Interlan reserves the right to make changes to its products without notice. Interlan assumes no responsibility for the use of this information.

IMPLEMENTS ETHERNET V1.0 SPECIFICATIONS

The NI1010 fully complies with the Xerox/Intel/DEC Ethernet V1.0 Specification. The board performs the specified Data Link and Physical Channel functions permitting 10Mbit per second data communications between stations separated by up to 2500 meters. As shown in Figure 1, the NI1010, when attached to a transceiver unit, provides a VAX-11 or Unibus-based PDP-11 a complete connection onto the Ethernet local area network.

PERFORMS ETHERNET DATA LINK LAYER FUNCTIONS

Within the Data Link Layer the NI1010 performs the specified Ethernet transmitter processes of Transmit Data Encapsulation and Transmit Link Management, and the Ethernet receiver processes of Receive Data Decapsulation and Receive Link Management.

Transmit Data Encapsulation

Figure 2 shows the Ethernet Frame Format for packet transmissions over the coaxial cable physical channel. For receive synchronization purposes, the frame is preceeded with a 64-bit preamble sequence and terminated with a minimum interframe spacing period of 9.6 microseconds.

The Destination Address field specifies the station(s) for which the frame is intended. The address value provided by the user may be either: 1) the physical address of a particular station on the network; 2) a multicast-group address associated with one or more stations; or 3) the broadcast address for simultaneous transmission to all stations on the network. The first bit of the Destination Address distinguishes a physical address from a multicast address (0 = physical, 1 = multicast). For broadcast transmissions an all one-bit pattern is used.

The Source Address field specifies the physical address of the transmitting station. To eliminate the possibility of an addressing ambiguity on a network, associated with each NI1010 is a unique 48-bit physical address value assigned to it at the time of manufacture. On transmission, the NI1010 inserts this value into the Source Address field.

The Type field is specified by the user for use by high level network protocols. It specifies to the receiving station(s) how the content of the Data field is to be interpreted.

The Data field may contain a variable number of data bytes ranging from a minimum of 46 bytes to a maximum of 1500 bytes. The NI1010 accepts less than 46 bytes from the user by automatically inserting null characters to complete a 46-byte minimum frame size.

The Frame Check Sequence (FCS) field contains a 32-bit cyclic redundancy check (CRC) value generated by the NI1010 during transmission.

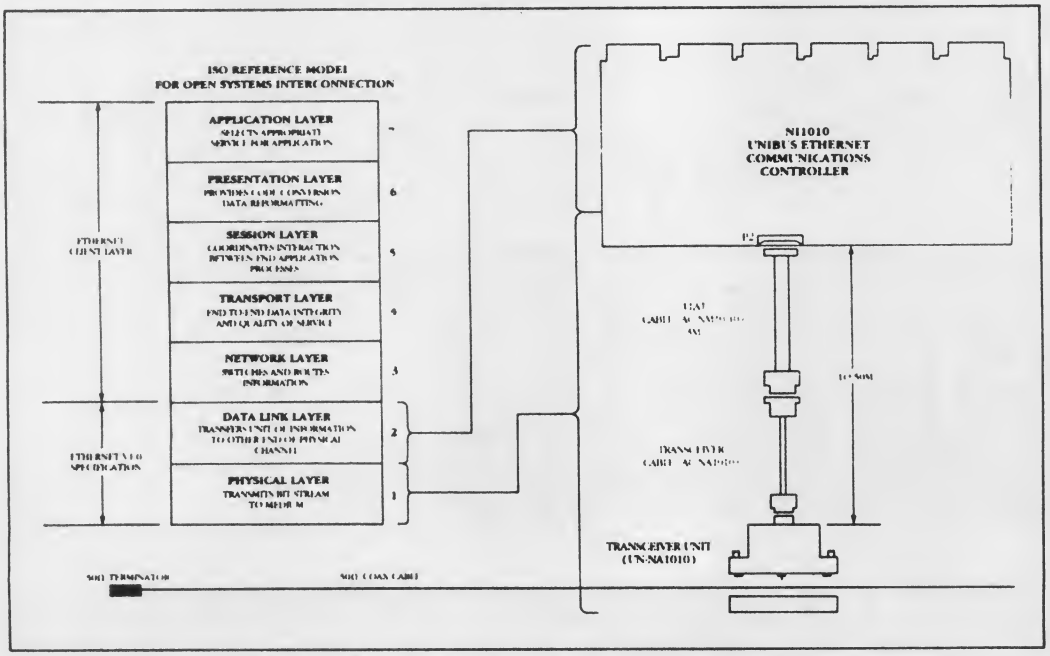


Figure 1. Ethernet Architecture and Implementation

Section 11

System Selection

Defining Requirements

- Applications
- Applications Software
- Systems Software
- Hardware
- Communications

When Not to Consider a P.C.

- Multiuser Systems
- Large Scale Database
- Mathematical Modeling
- Number Crunching
- Memory Requirements
- High Volume Office Work
- Resistant Staff
- High Volume Communications

SECOND GENERATION MICROCOMPUTERS

Manufacturer	CPU	Memory	Operating System	Graphic Resolution	Floppy Storage
Commodore BX256	8088	896K	CP/M-86	Block only	170K
DEC Rainbow 100	8088	256K	CP/M-86 MS-DOS	240 x 800	400K
Dynalogic Hyperion	8088	256K	MS-DOS	250 x 640	320K
Eagle 1600	8086	512K	CP/M-86 MS-DOS	240 x 340	780K
Grid Systems Compass	8086	512K	Compass	240 x 320	800K
Hitachi PC	8088	384K	MS-DOS	200 x 640	1M
IBM Personal Computer	8088	256K	MS-DOS CPM/86	200 x 640	320K
Mitsubishi Multi 16	8088	384K	CP/M-86 MS-DOS	400 x 640	300K
NEC Advanced Personal Computer	8086	256K	CP/M-86 MS-DOS	475 x 640	1M
North Star	8088	256K	MS-DOS	240 x 640	360K
Sony SMC-70 +SMC-7086	8088	128K	MS-DOS CP/M-86	400 x 640	280K
TeleVideo 1602	8088	256K	CP/M-86	240 x 640	360K
Toshiba T300	8088	512K	MS-DOS CP/M-86	400 x 640	1M
Vector Graphic 4	8088	256K	MS-DOS	312 x 640	630K
Victor 9000	8088	256K	CP/M-86 MS-DOS	400 x 800	1.2M
Wang P.C.	8086	640K	MS-DOS	300 x 800	320K
Zenith Z110	8088	768K	MS-DOS	225 x 640	1.2M
Corvus Concept	68000	512K	Corvus	560 x 720	600K
Fortune 32:16	68000	1M	Unix	480 x 800	800K
Radio Shack Mod 16	68000	512K	TRSDOS-16	240 x 640	1.2M
WICAT 150WS	68000	1.5M	MCS	300 x 400	630K
Olivetti M20	Z8001	512K	PCOS	256 x 512	280K

MULTIUSER SYSTEMS

Manufacturer	Users	RAM meg	Floppy meg	Hard meg	Operating System	Cost $
Action Computer	16	16	4.8	154	C,C6,P	3,700
Alpha Micro	64	8	2.4	2400	P	8-24,000
Altos Computer	8	1	2.0	80	C6,M6,O6,X	8-14,500
CIE Systems,Inc.	8	1	1.6	160	U,	
Columbia Data	8	1	1.2	40	C,M,C6,M6,MS	3-5,000
CompuPro	16	1	4.8	160	M,M6	9,000
Cromemco Inc.	6	4	4.8	11	P	4-7,000
Datavue Corp.	4	.256	1.0	38	C	6,000
Digital Microsystems	7	.512	1.0	92	O,M	7,000
Dynabyte Business	16	1.	.8	76	C6,M6,O6,U	11-14,000
Eagle Computer, Inc.	12	.512	1.6	10	O,X,M	5,000
Euclid Computer, Inc.	10	1.	1.2	30	M6,O6	6,000
Fortune Systems Corp.	16	1.	3.2	80	U	5,000
Gifford Computer	6	1.	4.8	80	C,C6,M6	12,000
IBS	16	1.	2.5	1100	UP	5,250
M/A-COM-OSI	6	.296	.3	160	P	12,700
Molecular Computer	32	1.	.5	128	C	8-18,000
NEC	16	1.	4.8	256	P	9-26,000
North Star	5	.344	None	90	H,C,P	5-8,000
Onyx Systems Inc.	8	1.	None	160	C,M,O,U	8-18,500
OSM Computer Corp.	8	.064	1.2	158	P	8-15,000
Systems Group	10				M,O,P	8-13,000
Televideo Systems Inc.	16	.128	.4	148	C,T	7-13,000
Texas Instruments Inc.	3	.512	None	172	P	10-22,000
Wicat Systems Inc.	6	1.5	1.0	60	P,U	10-12,000
Zilog Inc.	32	4.0	None	320	P	14-38,000

Operating System Key

C CP/M M MP/M C6 CP/M-86 M6 MP/M-86 O OASIS X XENIX

M MSDOS U UNIX U USCD PASCAL T TURBODOS P PROPRIETARY

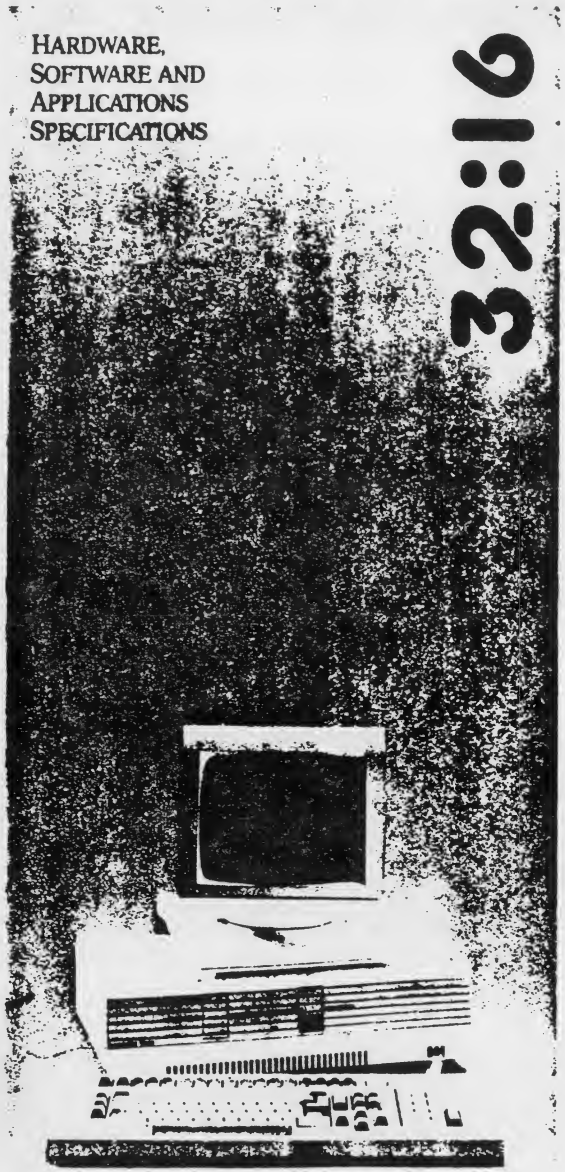
VP

Portable Micros

Company	Model	Price	RAM	Screen	Chip	Disk
Compaq	Compaq	$2,995	128K	9	8088	320K
Computer Dev.	Dot	3,495	64K	5	8088	288K
Computer Sys.	PC/8088	3,995	64K	9	8088	320K
Dynalogic	Hyperion	4,995	256K	7	8088	320K
High Tech.	Mayflower	3,350	64K	5	Z-80	1M
Jonos	Escort	3,995	64K	9	Z-80A	322K
Kaypro	II	1,795	64K	9	Z-80	192K
Micro-Source	M6000P	3,900	64K	9	Z-80A	386K
Osborne	01	1,795	64K	5	Z-80	102K
Otrona	Attache	3,995	64K	5	Z-80	360K
Seequa	Chameleon	1,995	128K	9	Z-80 8088	320K
Telcon	Zorba	1,595	64K	7	Z-80A	380K
	Nomis	2,395	64K	9	Z-80A	380K

FORTUNE SYSTEMS

HARDWARE, SOFTWARE AND APPLICATIONS SPECIFICATIONS



HARDWARE

The Fortune 32:16™ desktop microcomputer is designed for versatility and flexibility in the small to medium size business operation... from a one-person office to the department of a large corporation.

The Fortune 32:16 contains the most powerful and advanced microprocessor available...the Motorola MC68000. Its 32-bit architecture provides significantly higher performance than any other microprocessor in its price class. So while the Fortune 32:16 looks and costs like a desktop microcomputer, it performs like a medium size minicomputer.

Just as important is its flexibility. The Fortune 32:16 can easily and inexpensively be expanded from a single user to a multi-user operation. Or expanded even further into a multi-system local network configuration by using standard Ethernet™ designed by Xerox. And as faster plug-in components and peripherals become available, they can easily be added as well.

The Fortune 32:16 is also designed for quality and reliability. Because downtime is one thing business can least afford, every major component has been proven in tens of thousands of hours of on-line operation. And each individual unit undergoes comprehensive design, validation and production testing to assure trouble-free performance.

In addition, the Fortune 32:16 is attractive, lightweight and easily portable by one person. It features a video display which tilts and swivels for ease of operation; plus the convenience of a detachable keyboard.

MICROPROCESSOR
MOTOROLA MC68000
- 32-bit data and address registers
- 24-bit memory address bus
- 16-bit data bus
- 16 MB linear address space

MEMORY
256 KB—1 MB RAM
- 128 KB increments with parity
- 256 KB increments with parity or ECC

4 KB—16 KB ROM*
- hardware initialization routines
- automatic system configuration
- automatic self-diagnostics,
- memory error recovery

*Additional ROM and internal ROM diagnostics and configuration control are included with each I/O option.

STANDARD INPUT/OUTPUT CONTROLLERS
SERIAL ASYNCHRONOUS CONTROLLER (RS-232C)
- up to 19,200 bps

FLEXIBLE DISK CONTROLLER
- supports 1-4 flexible disks

OPTIONAL INPUT/OUTPUT CONTROLLERS
SERIAL ASYNCHRONOUS CONTROLLER (RS-232C)
- 2 or 4 ports, up to 19,200 bps

INTELLIGENT COMMUNICATIONS CONTROLLER (RS-232C)
- 2 or 4 ports, up to 19,200 bps
- high speed asynchronous
- high speed synchronous

PARALLEL I/O CONTROLLER
- 1 or 2 ports
- IEEE 488 interface
- Centronics interface

ETHERNET CONTROLLER
CHARACTER GENERATOR VIDEO DISPLAY CONTROLLER
BIT-MAPPED GRAPHICS VIDEO DISPLAY CONTROLLER
- monochrome or color graphics

WINCHESTER HARD DISK CONTROLLER
- supports 1-4 5¼" hard disks with DMA

HIGH PERFORMANCE HARD DISK CONTROLLER
- supports 1-4 5¼", 8", or 14" hard disks with DMA

NOTES: All Fortune 32:16 systems include five interchangeable input/output option slots *plus* the five memory slots (one for ECC) *plus* the two standard input/output controllers.

MAGNETIC STORAGE
1-4 1 MB (800 KB FORMATTED) 5¼" FLEXIBLE DISKS
1-4 5/10/20 MB 5¼" HARD DISKS
1-4 8" HARD DISKS
TAPE CARTRIDGE (20 MB)

VIDEO DISPLAY
HIGH QUALITY, NON-GLARE 12" MONOCHROME DISPLAY
- color monitor optional
- vertical tilt from +15° to −5°
- horizontal swivel (90°)
- 80 characters x 24 lines
- upper and lower case
- 288 characters
- international character set
- 13 special characters for word processing
- 15 limited graphic symbols
- attributes: overstrike, double underline
- underline, reverse video, blink, highlight

KEYBOARD
99-KEY, LOW PROFILE, DETACHABLE KEYBOARD
- sculptured standard typewriter layout
- 15-key numeric pad/9-key cursor control pad
- 16 programmable function keys
- full set of system level function keys, including Help, Cancel and Delete

SOFTWARE

The Fortune 32:16 desktop microcomputer performs all of the business functions of larger minicomputers. That's because it is based on the UNIX™ operating system developed by Bell Labs ...a *proven performer* with a ten-year record of versatility and reliability in the computer marketplace. This allows the Fortune 32:16 to perform a variety of functions ordinary microcomputers cannot... such as simultaneous multi-user, multi-function applications including accounting, word processing and financial modeling.

The Fortune 32:16 speaks your language, too. All operator selections are handled through simple, easy-to-read menus designed specifically for the first-time user. Plus, the Fortune 32:16 can talk to other Fortune 32:16 systems, other microcomputers, minicomputers and large corporate mainframe computers.

The Fortune 32:16 also speaks a number of high-level computer languages, including Basic, Cobol, Fortran, Pascal and C.

No other microcomputer has all of these capabilities.

FORTUNE™ OPERATING SYSTEM
BASED ON UNIX OPERATING SYSTEM
DEVELOPED BY BELL LABS
MULTI-USER/TIMESHARING SYSTEM
- multi-programming support/device independent I/O
- priority task scheduling/supports shared code

FILE MANAGEMENT SYSTEM
- full file protection/dynamic file allocation

COMPREHENSIVE UTILITY SET
- over 200 available utilities
- file management/text editing/development tools

FORTUNE ENHANCEMENTS
- single or multi-user version/flexible or hard disk support
- automatic configuration/performance improvements
- additional utilities/global menu interface

LANGUAGES
BASIC—SMC BUSINESS BASIC
- filters for most popular Basic languages

COBOL—ANSI 74 LEVEL 2
FORTRAN—77
PASCAL—EXTENDED ISO
C

COMMUNICATIONS
ASYNCHRONOUS
- CU, UUCP

BISYNCHRONOUS—BATCH
- 2780/3780, 3741, 2770, 2968

BISYNCHRONOUS—INTERACTIVE
- 327x

LOCAL NETWORKING
ETHERNET
- conforms to Xerox, DEC, Intel standard (9/80)

APPLICATIONS

Because the Fortune 32:16 combines the powerful MC68000 microprocessor with the multi-user UNIX based operating system, it can perform a broad range of business functions beyond the scope of most other microcomputers.

For example, the Fortune 32:16 can be used for sales order processing, invoicing, sales analysis and inventory control; as well as accounts receivable, accounts payable, purchase order processing, payroll, fixed assets, general ledger and report writing.

In addition, the Fortune 32:16 is the functional equivalent of the top selling word processing system in the commercial marketplace, but with many additional user-oriented enhancements. Designed specifically with the operator in mind, the Fortune 32:16 features a large number of dedicated function keys, extensive use of easy-to-read menus and highlighted prompt commands.

The Fortune 32:16 application software also includes the Multiplan™ financial modeling system used for forecasting, budgeting and reporting. This advanced system allows the operator to build "what if" financial models without knowing complex modeling language. In fact, the Fortune 32:16 guides the operator all along the way with easy to understand instructions on the screen.

The Fortune 32:16 also provides high resolution graphics, with the ability to mix word processing text and graphic representations in the same document.

Best of all, any combination of these applications can be run concurrently on the Fortune 32:16. And, because the Fortune 32:16 can handle all major high level languages, there are literally thousands of proven application packages available for use.

FORTUNE BUSINESS ACCOUNTING SYSTEM
FULLY INTEGRATED, SINGLE ENTRY SYSTEM
- Order Processing and Inventory Control
- Accounts Receivable
- Purchase Orders
- Accounts Payable
- Payroll
- Fixed Assets
- General Ledger

EACH MODULE ALSO AVAILABLE AS STAND-ALONE PACKAGE

IDOL® DATA BASE MANAGEMENT SYSTEM
DATA BASE MANAGEMENT FUNCTIONS
- data base creation and maintenance
- report writer subsystem/data entry subsystem
- data element security

INTERACTIVE SELECTOR FUNCTIONS
- menu definition/menu control
- system security/user utilities

DOCUMENTATION CONTROL FUNCTIONS
- text editing/text formatting/text control
- text printing

FORTUNE:WORD™ WORD PROCESSING SYSTEM
FUNCTIONALLY EQUIVALENT TO, AND A SUPERSET OF, THE NUMBER ONE WORD PROCESSING SYSTEM IN THE COMMERCIAL MARKETPLACE, INCLUDING:
- simultaneous printing/media storage format
- auto word wrap/decimal tab/auto underline
- auto centering/auto pagination
- character string search/block move copy
- file sort-select/auto footnote tie-in
- term dictionary-glossary/multiple hyphenation modes
- list processing

FORTUNE ENHANCEMENTS
- Help key/mixed text and graphics/free form file names/dynamically variable page end/true multi-column support—and many more

SIMPLIFIED USER INTERFACE
- large number of dedicated function keys
- extensive use of menus
- highlighted prompt commands

MULTIPLAN™ PROFESSIONAL SYSTEM
FORECASTING, BUDGETING AND MODELING SYSTEM WHICH IS A FULL SUPERSET OF THE NUMBER ONE PROFESSIONAL PACKAGE IN THE DESKTOP MICROCOMPUTER MARKETPLACE, INCLUDING:
- file merging/printing of both results and formulas/insertion of rows and columns into ranges without changing formulas/individual column width selection/independent column width headings/direction and help keys/full word command lines

GRAPHICS SYSTEM
12" MONOCHROME OR 13" COLOR MONITOR
- high resolution 16 color graphics (640 x 480)
- 132 column by 60 line print image display (800 x 480)
- software selectable pan (1024 x 1024)
- standard NTSC RGB output for larger monitors
- interlaced or non-interlaced display
- mixed text and graphics

This Is Lisa, From Apple.

You've never worked with a personal computer like it. Because Lisa™ works the way you do.

The system is so simple to use that you control it intuitively. Lisa has no conventional computer commands. Instead, you operate it by pointing to familiar pictures on the screen. You can actually learn to do useful work with Lisa in 20 to 30 minutes.

Lisa's radical simplicity is matched by its power. The system replaces conventional computer programs with a pool of powerful business tools. From it you spontaneously select what you need, exactly when you need it. Words, numbers, charts, graphs, pictures – Lisa lets you create and combine them naturally to produce clear answers to your questions and clear information for your organization.

The Lisa system. The only personal computer that's simpler and more powerful is your own mind.

The New Computing

Lisa at Work. You can do more using Lisa and one hand than you can using a conventional computer and both hands. That's because you control the entire Lisa system with a simple device called a mouse. The keyboard is just for typing.

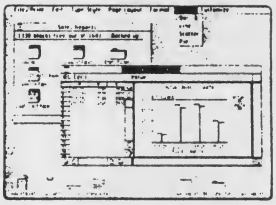
With the mouse, you control a pointer on the computer's screen. Point to the screen's graphic images, select what you want, and Lisa does the rest instantly. With incredible speed and simplicity — and without the usual thicket of computer commands — you handle every operation you need.

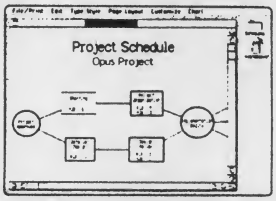
Using the mouse and Lisa's graphics, you can select and operate any business application; move information from one application (such as LisaCalc) to another (such as LisaWrite); create, examine, reorganize, and revise files; run modems, printers, and other peripheral devices; and communicate with central computers.

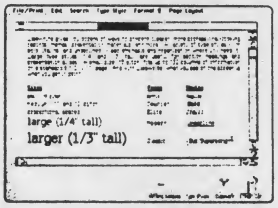
The mouse and the natural movement of your own hand. They're all you need to control Lisa. That makes it the one personal computer you already know how to use.

Learn Faster, Do More. Each of Lisa's six business applications is formidable. LisaCalc, LisaList, and LisaProject let you [illegible]sling, list management, and project scheduling. LisaWrite handles everything you write. LisaGraph and LisaDraw [illegible] create business graphs and virtually any other graphics that your work requires.

But what each application does is only the start. Working together, they do even more.

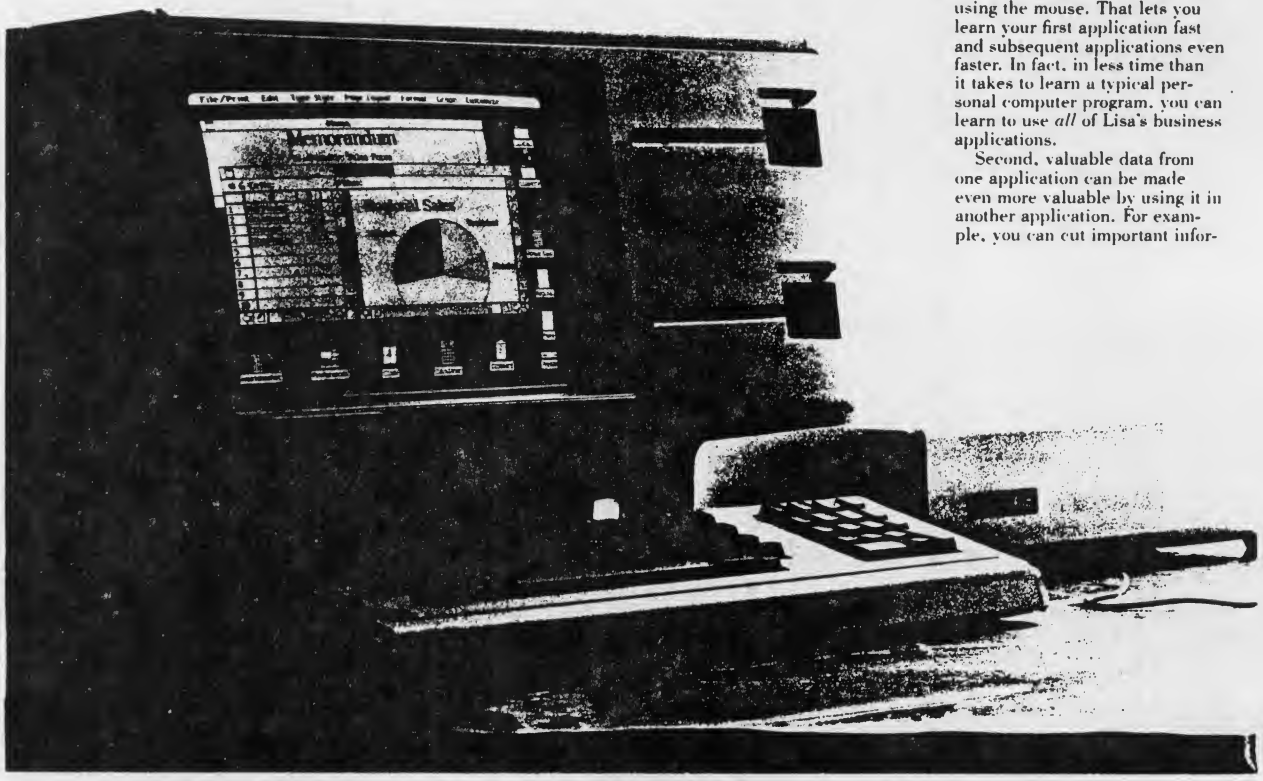






First, all of Lisa's applications are controlled in the same way, using the mouse. That lets you learn your first application fast and subsequent applications even faster. In fact, in less time than it takes to learn a typical personal computer program, you can learn to use *all* of Lisa's business applications.

Second, valuable data from one application can be made even more valuable by using it in another application. For example, you can cut important infor-



mation from LisaCalc and paste it into a LisaWrite report. The possibilities are endless. They're also simple and spontaneous because cutting and pasting are done in seconds, using only the mouse.

A Picture Vs. A Thousand Words. Lisa also gives you the unparalleled advantage of using pictures as easily as words. That lets you communicate in radically simpler, more powerful ways. Graphs and charts are just the start. Lisa's remarkable software frees you to create precisely the illustrations your messages need — everything from quick sketches in memos to sophisticated materials for presentations.

And Lisa lets you print all of it exactly as it looks on the screen. Lisa's dot matrix printer reproduces *all* your work with a sharpness matched only by printers that cost much more. Lisa's daisy wheel printer can duplicate anything on the screen, too, including graphics.

Lisa's integrated software and extraordinary graphics let you multiply the power of all your information. That gives you a business advantage that no conventional personal computer can offer.

Technology That Means Business

Unmatched Hardware. On your desk, Lisa is quiet (no fan), convenient (advanced ergonomics), and streamlined (reduced footprint). It also has the speed and capacity to crunch every task you use it for. The system has a 32/16-bit central processor, and one megabyte of main memory. It uses ProFile,™ Apple's high-speed hard disk storage device, to keep all business applications and files instantly available. Two built-in floppy disk drives handle an additional 1.7 megabytes of usable information and let you quickly make backup files, do automatic system tests, and use additional data, languages, and programs. Lisa also handles extra tasks, such as printing, while you continue important work on the screen.

Lisa's keyboard is standard and simple — the mouse replaces special function keys. The 12-inch, bit-mapped, black-on-white screen lets you create extraordinary graphics and up to 132 columns and 40 rows of sharp, clear text.

At the back of the system, you can plug in printers, modems (including auto-dial/auto-answer), and more.

Supersoftware. Lisa's six comprehensive applications are prodigious office tools for the most important business functions. Its sophisticated spreadsheet, list management, word processing, and graphing applications do far more and are easier to use than any typical personal computer programs. And Lisa's project scheduling and graphics editing applications do fundamental management tasks that are simply not possible with conventional personal computers.

These six are just the start. Three languages — powerful versions of BASIC, Pascal, and COBOL — let you use as well as write additional business programs. And with the Lisa Applications Development Tool Kit, programmers will be able to create Lisa-style programs that extend the system's powers even further.

Lisa In Your Office Today. Lisa's effectiveness starts as soon as you plug it in. The system performs all the powerful functions you need with stunning simplicity. Surprisingly, it's priced like many conventional personal computers. Even if your department's budget is limited, you can put Lisa to work now.

And Tomorrow. Better still, you can keep Lisa working even when your department grows. That's because the Lisa system expands in amazing ways. You can use Lisa to search valuable commercial data bases such as MicroNet, Dow Jones News And Quotes, and The Source. You can use Lisa as a terminal for corporate mainframes, central minicomputers, or virtually any other large computer system. And you'll be able to link together any of your Lisa systems (and other Apple computers) with AppleNet.™ the fast, inexpensive, reliable network being developed by Apple. AppleNet can start small and grow to cover your whole organization.

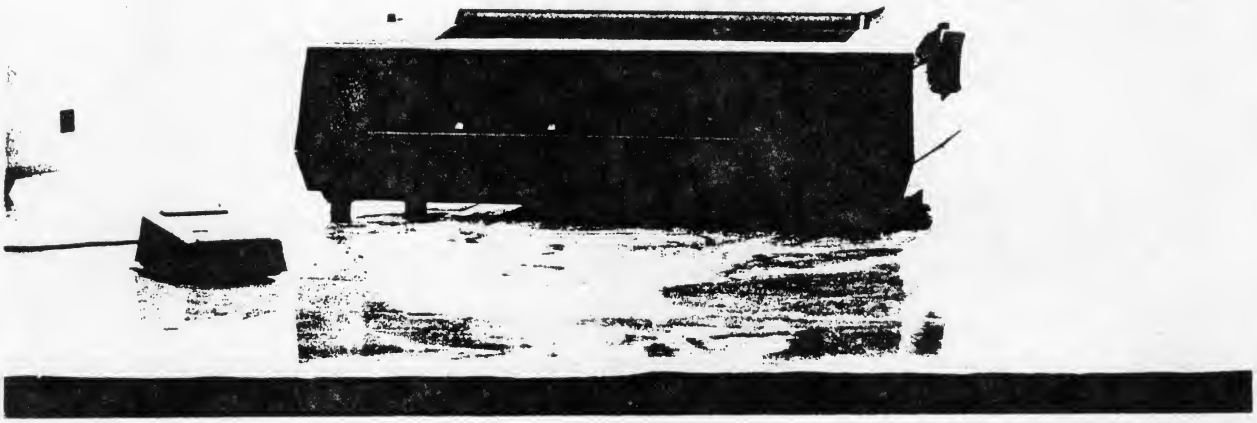
All Kinds of Backup. Support and service for Lisa are as flexible and comprehensive as the system itself.

Lisa instruction, for example, is efficient in organizations of any size. With the system's innovative self-teaching materials, a single user can put Lisa to work in less than 30 minutes. Self-instruction for conventional personal computers takes about ten times as long. And if whole departments need to learn en masse, Apple can provide complete training programs — and even help your business develop its own specialized programs.

Service for Lisa is just as broad. You can get fast, economical service for any number of systems. You can even set up your own service department. Apple can provide all the training and supplies.

In a word, no matter how you put Lisa to work in your company, you'll have support and service that work the way you want.

The Lisa System. You Should Know More.
It's the only personal computer that works the way you do. To learn how you can put Lisa to work, call Apple at 800-662-9238. We'll give you the phone number of the national accounts office or authorized Lisa dealer in your area.



Specifications

Display:
- 12 inch screen (measured diagonally).
- Full-screen bit-mapped display
  - 364 lines by 720 dots.
  - up to 40 lines of 132 characters.
- 60 Hz refresh rate.
- Contrast level under software control.
- Contrast-enhancing screen.

Keyboard:
- Detached, standard typewriter-style.
- N-key rollover.
- Sculptured keytops
  - textured, nonslip, nonglare.
- Numerical keypad with raised dot on 5 key.
- Full ASCII character set, up to 77 keys.
- All keys programmable.
- Smart interface with control-oriented processor.

Mouse:
- Extremely fast, intuitive cursor positioning.
- Works well on any surface.
- Simple one-button design eliminates confusion and the need to learn commands.

Disk storage:
- 860K bytes (per drive) formatted storage.
- 1.4M bytes (per drive) unformatted capacity.
- 62.5 tracks/inch.
- 10,000 bits/inch.
- Automatic disk eject.
- Smart interface with 6504 processor.

Main processor:
- MC68000 32/16-bit CPU
  - 32-bit internal architecture.
  - 16-bit external data path.
  - Seven levels of interrupts.

Real-time clock:
- Software system on-off control.
- Interval and event timing.
- COPS processor, battery backup.

Main memory:
- 16K bytes of boot ROM.
- Up to 1M bytes RAM.
- Parity error detection.

Memory management:
- Permits operating system to relocate segments in memory.
- Provides access controls for block memory.
- Segmentation into 128 variable-length blocks.

Communications interface:
- Two serial ports
  - SCC controller.
  - programmable
  - full-function.
- RS-232 with full-duplex channels.
- Full modem control and ring indicator on one channel.
- Baud rates software-programmable.
- One parallel port
  - 8-bit bidirectional.
  - handshake control.

Audio output:
- Built-in speaker with software-controllable tone generator.

Expansion board slots:
- Three slots.
- Zero insertion-force connectors.
- Direct connection to system bus.
- DMA capability.
- Memory-mapped I/O.
- Vector interrupt capability.
- Direct connection of power supply:
  - digital ground.
  - +5V, −5V, +12V, −12V.
  - allows up to 10W total (maximum rating) for all three cards.
  - +5V standby (at 58 mA) per board.

Weight and dimensions:
- Computer console:
  - Weight: 48 lb. (22 kg).
  - Height: 13.8 in. (350 mm).
  - Width: 18.7 in. (475 mm).
  - Depth: 15.2 in. (388 mm) [16 in. (403 mm) with keyboard under front].
- Keyboard:
  - Weight: 4 lb. (1.8 kg).
  - Height: 2.7 in. (68 mm).
  - Width: 18.7 in. (475 mm).
  - Depth: 6.5 in. (165 mm).

Power requirements:
- 115 or 230 V. AC.
- 48 to 68 Hz.
- 270 W (maximum).

Environmental requirements:
- Ambient temperature: 40°–108° F (5°–42° C).
- Relative humidity: 15–80%, noncondensing.

Applications:
- LisaCalc (spreadsheet modeling), LisaList (list management), LisaProject (project scheduling), LisaWrite (word processing), LisaGraph (business graphics), LisaDraw (graphics editor), LisaTerminal (terminal emulation).

Languages and development environment:
- BASIC, Pascal, COBOL, Lisa Editor, Assembler, Linker, Debugger, and a wide range of utilities.

Communications:
- 3270 BSC.

System expansion:
- Apple Dot Matrix Printer, Apple Daisy Wheel Printer, Apple ProFile (5MB hard-disk storage device), Modem, 2-port parallel card, and AppleNet Local Area Network (Ethernet connections available for Apple products).

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Product specifications may change without notice

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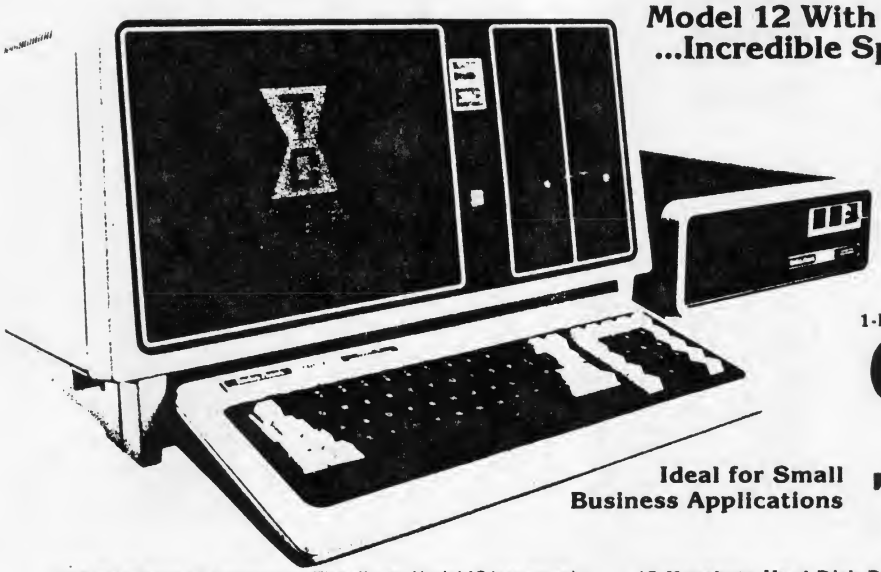
Step Up to a TRS-80® Hard Disk System



Model 12 With 12-Meg Hard Disk ...Incredible Speed and Storage!

Quickly Access Over 12 Million Characters of Data

Upgradable to Our Multi-User System And Up to 768K Memory

Compatible with Our New CP/M Plus Operating System

1-Drive Model 12 and Hard Disk

6893.00

Plus Installation

2-Drive Model 12 and Hard Disk (As Shown)

7693.00

Plus Installation

Ideal for Small Business Applications

TRS-80 Model 12 Computer. The all-new Model 12 is a remarkable, stand-alone business system that offers a unique combination of power, versatility and easy expandability. It's fully compatible with our popular TRS-80 Model II software, so it's ready right now to handle accounting, word processing, electronic filing, and forecasting applications; meet program development requirements; even be outfitted for communications with mainframe computers. Model 12 is available with one or two built-in 1.25-megabyte thin-line disk drives, and includes a high-resolution 80x24 green screen and detachable, low-profile 82-key typewriter-style keyboard. U.L. listed.

TRS-80 Model 12 with 1 Drive. 26-4004 ..... 3199.00

TRS-80 Model 12 with 2 Drives. 26-4005 ..... 3999.00

12-Megabyte Hard Disk Drive. Now you can have vastly increased data storage capacity—with exceptionally fast access times—through powerful Winchester technology. Combine the new 12-megabyte hard disk with the TRS-80 Model 12 microcomputer (requires card cage and installation) and you'll have a fast and powerful computing system to handle a variety of large data applications. The advanced operating system's many superior, user-friendly features make file handling a breeze. Expand your system with up to three secondary drives for a total of over 48 million characters of storage. (Not compatible with our 8-megabyte hard disks.) U.L. listed.

Primary Hard Disk. 26-4152 ..... 3495.00

Secondary Hard Disk. 26-4153 ..... 2495.00

Expansion is Easy with the New TRS-80 Model 12 Card Cage

199.00

- **Tremendous Expansion Flexibility**
- **Mounts Inside Model 12's Case**

Provides six additional plug-in slots for inserting our optional-extra expansion boards (described here) to meet growing or changing requirements. Card Cage and boards require installation, not included.
26-6017 ..... 199.00

16-Bit Power and More Memory

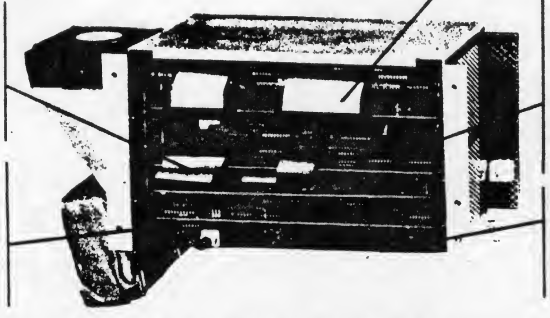
You can get true 16/32-bit processing, perform complex computing tasks with ease and have multi-user capability by adding our powerful Model 16 Upgrade Kit and memory options.

High-Res Graphics

Create amazingly detailed on-screen charts and graphs that can simplify rows of complicated numerical data with our High-Resolution Graphics Board.

Hard Disk Expansion

This special controller board allows you to interface hard disk drives with your Model 12 computer for up to 48 megabytes of data storage. (Included with primary hard disk.)



Future Expansion

Even with all the expansion items mentioned here, Model 12 gives you still more room to meet growing or changing requirements. For example, you can use this slot to add a special 64K memory expansion board and our Enhanced VisiCalc program to generate extremely large worksheets.

Local Networking

With our new ARCNET™ system, you can link any combination of up to 255 TRS-80 Model 12 or Model II computers for high-speed local networking.

12 **Model 12 is Ideal for Small Business Use—as Well as Departmental Use in Big Businesses!**

The basic components

IBM offers you a choice of two versatile, easily expandable personal computer systems: the IBM Personal Computer and the IBM Personal Computer XT. Both systems provide a number of advanced hardware design features at a reasonable cost ... and both provide a wide range of capabilities to meet business, professional, educational and personal needs.

The XT *extends* the storage capacity and information handling capability of the IBM line of personal computers. It comes with a 10MB (10,240,000 characters) fixed disk drive ... allowing faster and more convenient access to larger volumes of information and more sophisticated programs.

The basic components of a personal computer system from IBM include a System Unit and Keyboard. For viewing information, the optional IBM Color Display or IBM Monochrome Display may be used. For producing documents, the optional IBM Graphics Printer may be used. In addition, an Expansion Unit may be added to your system configuration to increase storage capacity and add more features or devices.

IBM Personal Computer System Unit.
Highlights include:
- 64KB (65,536 characters) user or Random Access Memory (RAM) standard ... expandable up to 256KB (262,144 characters) on the System Board and up to 640KB (655,360 characters) by adding memory feature cards
- 40KB (40,960 characters) permanent or Read Only Memory (ROM), which contains the easy-to-use BASIC language
- Choice of one or two 160/180KB (with DOS 2.0) or 320/360KB (with DOS 2.0) diskette drives to support single sided or double-sided, double-density, 5¼-inch diskettes
- High performance, high-speed, 16-bit microprocessor (8088)
- Five expansion slots which allow easy system expansion with optional plug-in adapters
- Speaker for audio and music applications
- Power-on automatic self-testing of system components

IBM Personal Computer XT System Unit.
Highlights include:
- 128KB (131,072 characters) user or Random Access Memory (RAM) standard ... expandable up to 256KB (262,144 characters) on the System Board and up to 640KB (655,360 characters) by adding memory feature cards
- 40KB (40,960 characters) permanent or Read Only Memory (ROM), which contains the easy-to-use BASIC language
- One 5¼-inch 10MB (10,240,000 characters) fixed disk drive
- One 5¼-inch, double-density, double-sided 360KB capacity (368,640 characters) diskette drive. (The capacity of a 320KB diskette drive is increased to 360KB when operating with DOS 2.0.)
- High-performance, high-speed, 16-bit microprocessor (8088)
- Eight expansion slots which allow easy system expansion with optional plug-in adapters. (Three of the expansion slots are used by the Asynchronous Communications, Fixed Disk Drive and Diskette Drive Adapters.)
- Built-in Asynchronous Communications Adapter which enables the XT system to communicate with a variety of outside devices or networks
- Speaker for audio and music applications
- Power-on automatic self-testing of system components

The IBM Personal Computer XT offers you a lot of storage, fast access to programs and data, and extra convenience.

Keyboard. The IBM Personal Computer and the IBM Personal Computer XT are controlled from a slim, light weight, multifunctional keyboard. It features:
- Flexible, 83-key typewriter-like format that makes it easy to learn and operate the system
- Six-foot coiled cable that allows convenient movement of keyboard
- Adjustable typing angle to suit your working position
- Tactile and audio feedback to help reduce typing errors
- 10-digit, calculator-like numeric keypad for entering numbers quickly and easily
- 10 special function keys for activating commonly repeated tasks
- Special "print screen" key

Display options. The IBM Color Display and the IBM Monochrome Display may be used to view information with both the IBM Personal Computer and the IBM Personal Computer XT. In addition, you have the option of attaching a standard color or black-and-white video monitor,* or a TV set* using an RF modulator.*

IBM Color Display. With the optional Color/Graphics Monitor Adapter, this unit can be easily attached to your system*. It provides:
- Up to 25 lines of text (uppercase and lowercase) with either 40 or 80 characters per line
- Text mode capable of displaying 256 characters in 16 foreground or character colors on any one of 8 background colors
- High-resolution black-and-white graphics mode
- Medium-resolution color graphics mode, which allows you to use one of two sets of colors at a time (Each set includes three colors that may be used against a fourth, background color.)
- High-resolution 8 x 8-dot character matrix on a 12½-inch screen (diagonal measurement)
- Brightness and contrast controls for viewing comfort
- Highlighting choices are: underlining, blinking, reverse image and high-intensity

IBM Monochrome Display. With an optional plug-in adapter, the IBM Monochrome Display can be easily attached to your system* for viewing information. This high-resolution display is powered by the System Unit. It provides:
- Up to 25 lines of text (uppercase and lowercase) with either 40 or 80 characters per line
- Green phosphor characters on an 11½-inch (diagonal measurement) anti-glare screen
- 7 x 9-dot text character size within a 9 x 14-dot box
- Brightness and contrast controls for viewing comfort
- Highlighting choices are: underlining, blinking, reverse image and high-intensity

IBM Graphics Printer. Here is a low-cost, versatile matrix printer which can be easily attached to your system* with an optional plug-in adapter. The printer offers:
- Both graphic images and a range of text characters
- 9 x 9-dot character matrix
- Choice of 18 different character styles
- Speeds of up to 80 characters per second
- Four modes of all-points-addressable graphics

Optional plug-in adapters

Optional adapters plug right into expansion slots located in the rear of both the IBM Personal Computer System Unit and the IBM Personal Computer XT System Unit... allowing you to increase memory size, add diskette drives and attach a variety of features or devices to meet your personal computing needs, today as well as tomorrow.

Color/Graphics Monitor Adapter. With this plug-in adapter, you have a 40- or 80-column text system that can display 256 different characters in up to 16 foreground or character colors on any one of 8 background colors. The adapter provides a matrix of 320 dots across and 200 dots down (64,000 dots) that can be controlled independently of one another.

Communications adapters. IBM offers three different communications adapters to help you access outside information networks or services, "host" systems and other remote devices. These include the Asynchronous Communications Adapter, Synchronous Data Link Control (SDLC) Communications Adapter, and Binary Synchronous Communications (BSC) Adapter. With the appropriate adapter and communications support program, you may link your system with a wide range of mainframe computers or devices by emulating:

- Terminals using asynchronous protocols such as the IBM 3101 and a start/stop teletypewriter
- IBM Systems Network Architecture (SNA) 3270 series of display stations using SDLC protocols
- SNA Remote Job Entry (RJE) terminal using SDLC protocols
- IBM 3270 type terminal using BSC protocols

The Asynchronous Communications Adapter is standard with the IBM Personal Computer XT. It is an optional feature with the IBM Personal Computer. This plug-in adapter provides an RS-232-C standard interface for communicating at speeds of from 50 to 9,600 bits per second. The adapter allows you to establish a link with a variety of devices or networks by telephone using a modem,* or directly by cable if the devices are nearby.

Game Control Adapter. Although joysticks and game paddles are not part of the personal computer offerings from IBM, they can be connected to either System Unit with the Game Control Adpater to move objects on the display when playing sound and action video games.

Prototype Card. The Prototype Card can be used as a base for building and testing custom attachments. It provides pre-printed circuitry and module holes for interfacing with your system, and requires one full-length expansion slot.

Memory Expansion Option. The 64/256KB Memory Expansion Option is available to extend user memory beyond the maximum amount that may be installed on the System Board. This memory option plugs into an expansion slot in the rear of either System Unit. The 64/256KB Memory Expansion Option is expandable by adding one, two or three 64KB Memory Expansion Kits for up to 256KB. Up to two Memory Expansion Options may be installed.

The IBM Personal Computer can help you in a variety of applications and enhance your creativity.

The next step

For more information on personal computer hardware offerings from IBM, speak with your IBM Marketing Representative, or visit the IBM Product Center nearest you.

You can also receive information on system software – including the Disk Operating System with Disk BASIC and Advanced BASIC, as well as other operating systems and programming languages that are available. You can also ask about the broad range of applications programs that have been carefully selected by IBM to help you get the most out of your personal computer investment. These software packages can help you meet a variety of business, educational, professional and personal needs.

*Video monitors, IBM sets, modems, joysticks, paddles and RF modulators are not part of personal computer offerings from IBM and must be purchased separately.

Hardware specifications

IBM Personal Computer XT System Unit
Size: Width – 20", Depth – 16", Height – 6"
Weight: 32 lbs
User memory: Cycle time – 410 nanoseconds; Access time – 250 nanoseconds
Environment: Air temperature – 60° to 90°F System ON, 50° to 110°F System OFF; Humidity – 8% to 80% System ON, 8% to 80% System OFF; Noise levels – 50DB without printer, 66DB with printer; Electrical – 120V AC, 60 cycles, 200 watts

IBM Personal Computer System Unit
Size: Width – 20", Depth – 16", Height – 5.5"
Weight: Without diskette drive – 21 lbs.; with one drive – 25 lbs.; with two drives – 28 lbs.
User Memory: Cycle time – 410 nanoseconds, Access time – 250 nanoseconds
Environment: Air temperature – 60° to 90°F System ON, 50° to 110°F System OFF; Humidity – 8% to 80% System ON, 8% to 80% System OFF; Noise levels – 50DB without printer, 66DB with printer; Electrical – 120V AC, 60 cycles, 200 watts

Keyboard
Size: Width – 20", Depth – 8", Height – 2"
Weight: 6 lbs.

IBM Color Display
Size: Width – 15 1/2", Depth – 17", Height – 11 1/2"
Weight: 26 lbs

IBM Monochrome Display
Size: Length – 14.9", Depth – 13.7", Height – 11"
Weight: 17.3 lbs.

Expansion Unit
Size: Width – 20", Depth – 16", Height – 6"
Weight: 27 lbs.
Fixed disk transfer rate: 5M bits per second
Fixed disk average access time: 90 milliseconds
Environment: Air temperature –60° to 90°F System ON, 50° to 110°F System OFF; Humidity – 8% to 80% System ON, 20% to 80% System OFF; Noise levels – 50DB without printer, 66DB with printer; Electrical – 120V AC, 60 cycles, 200 watts

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White Plains,
New York 10604

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IBM

Eagle Computer 1600 Series Business Computer

EAGLE COMPUTER

- **IBM Personal Computer compatible**
- **Up to 13.5 Megabyte storage capacity**
- **Word processing, financial planning, and operating system software included.**

The new Eagle series offers all the features of the IBM personal computer combined with greatly increased speed, memory and storage demanded for efficient business applications. It is intended for the user who has a need for extensive internal memory, generous storage capacity, access to a wide range of applications software, and the ability to network up to 64 terminals.

The Eagle 1600 series is designed as a fully upgradable system with multiple hardware and software options. An introductory version offers 128 kilobytes of random access memory, one 5¼" floppy disk drive storing one megabyte (780 kilobytes formatted), and one Winchester hard disk drive storing 12½ megabytes (10 megabytes formatted). The combined storage capacity of the hard disk and single floppy disk is 6000 pages. Each is housed in the low-profile processing enclosure containing the system electronics. Computer memory is expandable to 512 kilobytes RAM, and disk storage is expandable with the addition of an add-on (10 or 40 megabytes) hard disk drive.

The attractively designed keyboard on all systems contains 105 keys with 24 dedicated to user-definable functions as well as the desirable two-key rollover feature. It is a separate, sculpted unit attached by a lengthy cord to allow operator positioning.

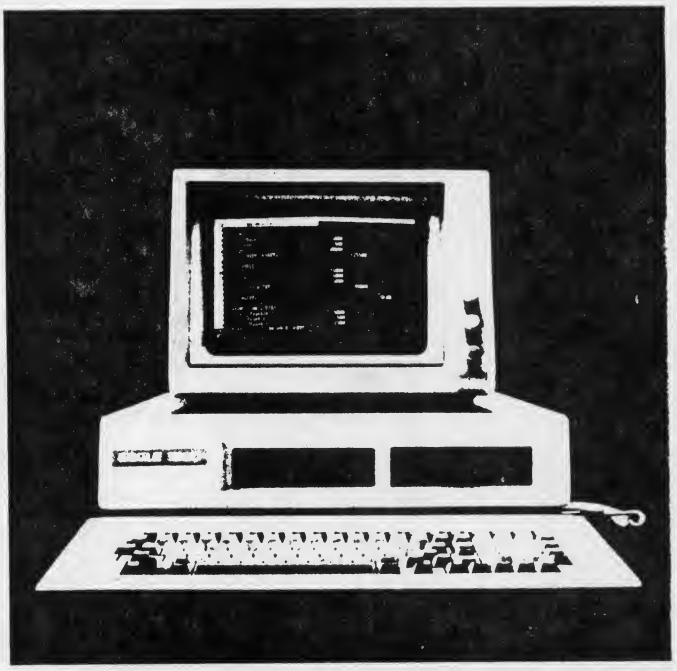
The Eagle 1600 series offers black and white and color graphics options. The black and white graphics is of extremely high quality consisting of 80 x 25 display, 9 x 14 dot matrix, with 720 x 352 pixel graphics. An amber monitor will also be offered for those preferring this color. The compact monitor is conveniently positioned atop the processor unit for best visibility.

Included with each Eagle 1600 are word processing and financial planning software. Both understand English instructions to guide the user smoothly through program functions and uses. With a single keystroke, preprogrammed function keys perform operations that would normally require several keystrokes. This feature greatly speeds work and use. Financial planning is made easy with the comprehensive electronic worksheet included. Word processing automates letters, reports, and mailing lists. Both programs are explained with built-in help instructions.

The MS-DOS* operating system included with the Eagle 1600 ensures compatibility with the IBM personal computer software library. Simply insert an IBM formatted diskette into the Eagle and run the program. Optional operating system for this product is CP/M-86*. Optional applications software includes general accounting, medical and dental practice management, and C.P.A. accounting.

The Eagle 1600 systems will provide for local area networking with other computers in the Eagle product line. Up to sixty-four computers may be added to the Eagle 1600 for a multi-user network allowing each user access to common information.

The 1600 series uses the Intel 8086 microprocessor operating at 8 MHz for greater processing speed—three to four times the speed of the IBM PC. Up to eight IBM plug compatible boards can be added for memory and I/O alternatives to enhance the Eagle system.



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MS-DOS is a registered trademark of Microsoft Corporation.
CP/M-86 is a trademark of Digital Research, Inc.
IBM Personal Computer is a trademark of International Business Machines Corp.

Eagle 1600 Business Computer

		Features	Benefits
System		Modular design. Three units: keyboard, monitor, and processor	Easy to install and move. Tailor to your office environment.
Hardware	System processor	Intel 8086(8 MHz)	Fast data storage and retrieval.
		Component design.	Ease of installation.
		Single, multi-layer printed circuit board	Increased reliability.
	Interface capabilities (optional system peripheral boards) 8 slots available.	2 serial ports	Printer or telephone communications. One fully synchronous.
		8 serial ports	Addition of local or remote terminals.
		1 parallel port	Printer installation.
		1 SASI adapter	Add-on hard disk expansion.
		1 LAN adapter	High speed local area network.
		1 VCR adapter	Video tape backup.
		1 video/graphics controller	Provides full IBM character set plus a 720x352 pixel graphics mode.
	Storage devices	Direct Memory Access controller	Fast disk access.
		1 floppy disk drive	Stores approximately 500 pages of text.
		1 hard disk drive	Stores approximately 5000 pages of text.
	Keyboard	105 key stations	Sculpted design, typewriter layout.
		24 user definable	Performs functions with one keystroke.
		Full numeric key set	Speeds entering of numbers.
	Video Display	12" high resolution, green phosphor, anti-glare display	Superior readability.
		80 characters wide, 25 long.	Maximizes text display.
Software		MS-DOS operating system. CP/M-86 (optional)	Industry standard operating system allows compatibility with programs written for IBM Personal Computer.
		Automatic floppy disk booting	Immediate, turnkey start-up.
		Word Processing	Software included.
		Financial Planning.	Software included.
		Selectable communications rates 75 to 9600 baud	Allows user to control information transfer to modem or printer.
		Operates most available printers	User can select quality and style of printer.

		Technical Specifications
System	Dimensions	Monitor: width: 13.5"/height: 11"/depth: 13"
		Processor: width: 19"/height: 5.5"/depth: 19.5"
		Keyboard: width: 19"/height: 1.75"/depth: 8.75"
Hardware	System Processor	Intel 8086 operating at 8 MHz. 128K bytes of internal memory, 512K bytes maximum
	Interface Capabilities.	2 RS232 serial ports
		1 parallel port
		8 RS232 serial ports (optional)
		1 SASI (included with hard disk system)
		1 LAN adapter (optional)
		1 VCR adapter (optional)
		8 slot IBM compatible expansion bus
	Storage Devices	1 double sided, double density floppy disk drive storing 1M byte (780 K bytes formatted)
		1 12.5 M byte hard disk drive (10 M bytes formatted)
	Keyboard	105 key stations. 24 special function keys
	Video Display	12" P39 green phosphor, high resolution, anti-glare
		Display area: 80 characters per line, 25 lines
		9x14 dot matrix video character format
Software	Operating System	MS-DOS (CP/M-86 optional)
	Word Processor	Software included with complete documentation
	Financial Planner	Software included with complete documentation
Power Requirements		Switching power, 115/220 VAC, 50/60 Hz
Warranty		The Eagle 1600 has a Limited Warranty 90 days for labor, and 1 year for parts from date of purchase.

EAGLE COMPUTER

8086 is a registered trademark of Intel, Inc.
MSDOS is a registered trademark of Microsoft Corporation
CP/M-86 is a trademark of Digital Research, Inc.
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Eagle Computer, Inc. 983 University Avenue Los Gatos California 95030 (408) 395-5005

Rainbow 100 specifications

HARDWARE:

System Unit	
Height	6.5 inches
Length	19 inches
Width	14.3 inches
Maximum Weight	30 pounds
Line Current	3A @ 115 Vac 1.5 @ 230 Vac
Power Consumption	218 Watts
CPUs	Z80-8088 dual microprocessors
Main Memory	64 Kbytes standard 256 maximum
Diskette Data Storage	One drive containing 2 diskettes (2 x 400Kb) standard Second drive (2 x 400Kb) optional, 1.6Mb maximum
Media	5¼ inch diskettes, formatted, dual density
Screen Display	Maximum 132 columns wide Selectable 80 columns wide
Screen Attributes	Bold, blink, underline, reverse
Communications Port	RS423 Asynchronous/byte synchronous
Printer Port	Serial

HARDWARE OPTIONS:

Bit map Color Graphics Option	High resolution 800 x 240, 4 colors Low resolution 400 x 240, 16 colors
External Disk Drive	5 Mbyte Winchester
Extended Communications Option	Two ports (RS423, RS422)
System Unit Stand for Vertical Mounting	

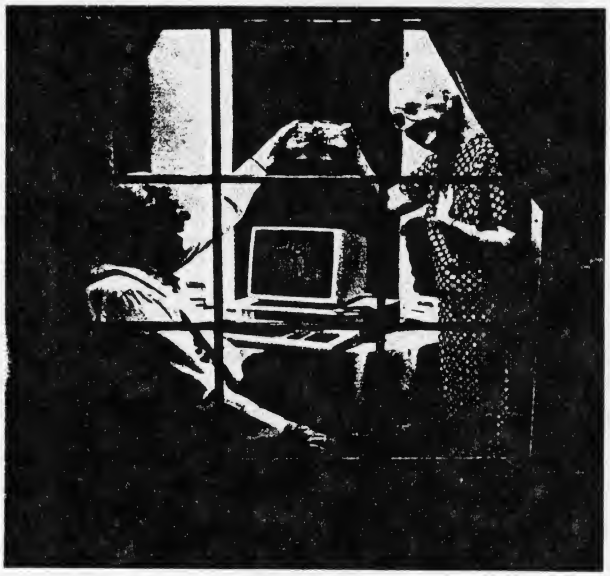
HARDWARE CONTROL FEATURES

- Print screen control
- Console control of communications
- Operator control of screen width
- BW or reverse display
- Operator control of screen intensity
- Keyclick control

OPERATING SYSTEM FEATURES

- Integrated CP/M 86/80 utilizing Z80 and 8088 CPUs
- Automatic use of correct processor for program
- Complete built in computer based training course
- Full screen editor standard
- Screen oriented file manager
- Full complement of programming tools

The information in this document is subject to change without notice and should not be construed as a commitment by Digital Equipment Corporation.



SPECIFICATIONS

CPU and Memory	
Main CPU	Z80A Microprocessor, 4 MHz Clockrate
Main Memory	64K to 256K RAM
CMOS Memory	2K RAM Battery Backup
IPL	Up to 8K
Controllers	
Video/Graphic	NEC 7220 Graphic Display Controller
Disk	Double Density Floppy Disk Controller
DMA	Programmable DMA Controllers 1 Main System } 7 DMA Channels 1 Option Slot }
Interrupt	Programmable Interrupt Controllers (15 Interrupt Levels)
Control/Timer	Two Programmable Interval Timers
Printer I/F	Programmable Parallel Interface
Serial I/F	Multi-Protocol Serial Controller
Clock	CMOS Realtime Clock/Calendar with Battery Backup
Display	12" Green Monochrome High-Resolution Monitor 640 x 400 Pixels 80 characters x 25 lines Non-Glare Screen Dedicated Memory 32K or 128K
Mass Storage	Two 5¼-inch, Double Sided Floppy Disk Drives; Capacity: 340K Per Disk
Detachable Keyboards	ASCII HASCI

Interfaces	
Serial	RS-232 Programmable, DB-25 Connector, Synchronous or Asynchronous
Printer	Standard Parallel
Light Pen	
Option slots	Five
Speaker	Controlled by Countertimer
Environmental Requirements	
Temperature	Operating Range 41° to 104°F (5° to 40°C) Storage Range 22° to 158°F (−30°C to 70°C)
Humidity	Operating Range 10% to 80% Non-Condensing Storage Range 10% to 90% Non-Condensing

Physical Characteristics

Size	CPU	Monitor	Keyboard
Width	20.3 in (508mm)	12.4 in (312mm)	20 in (510mm)
Depth	13.6 in (340mm)	13.6 in (340mm)	8.9 in (224mm)
Height	4.1 in (103mm)	10.6 in (266mm)	1.9 in (49mm)
Weight	20.6 lb (9.4kg)	12.1 lb (5.5kg)	5.5 lb (2.5kg)

Power Requirements	115 VAC, 60 Hz; with Switching Power Supply 100 Watts

Specifications subject to change without notice.

EPSON
EPSON AMERICA, INC.
COMPUTER PRODUCTS DIVISION

3415 Kashiwa Street • Torrance, California 90505 • (213) 539-9140

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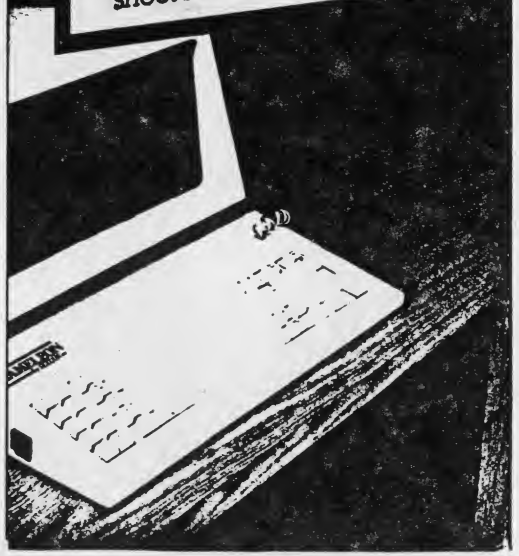
...HAS TWICE THE FEATURES FOR $1995:

- IBM-PC* and CP/M-80* compatibility: Standard
- 8-bit and 16-bit processors: Standard
- 128K bytes RAM: Standard
- Word processing and spreadsheet software: Standard



STANDARD HARDWARE
Processors: 8088 — 16 bit (IBM-PC compatible) Z80A — 8 bit
RAM: 128K bytes (expandable to 256K)
ROM: 8K bytes (expandable to 48K)
Disk: Dual 160K byte 5¼" disks (IBM PC compatible)
Display: 9" CRT with green phosphor
I/O: One serial RS-232 port One parallel port
Keyboard: 83-key (IBM-PC compatible) with 10-key numeric pad and 10 function keys
Graphics: Black and white: 640 × 200 or 320 × 200 resolution Color (on separate color monitor): 320 × 200 resolution, 16 color, 4 at a time
Portable
STANDARD SOFTWARE
Operating system: MS-DOS (IBM PC-DOS compatible)
Development language: MBasic-86 (IBM compatible)
Word processing: Perfect Writer
Spreadsheet: Perfect Calc
OPTIONS
CP/M-80 8 bit operating system
CP/M-86 16 bit operating system
GWBasic (advanced graphics Basic)
Additional 128K RAM internal
Hard disk
Double sided floppies (320K bytes each)
A/D port
Serial port for bisynchronous communications
IEEE-488 bus
Chameleon expansion unit (IBM-PC board compatible) *Additional memory (up to 704K bytes total) *Additional functions (IBM-PC expansion cards)

SEEQUA COMPUTER CORPORATION
209 West Street
Annapolis, MD 21401
(301) 268-6650

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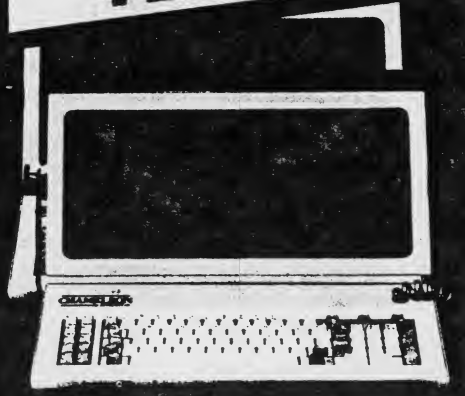
*The following are registered trademarks
CP/M-80 — Digital Research Inc.
CP/M-86 — Digital Research Inc.
MS-DOS — Microsoft
PC-DOS — International Business Machines
Perfect Writer — Perfect Software
Perfect Calc — Perfect Software
MBasic — Microsoft
GWBasic — Microsoft
IBM — International Business Machines.

TWICE THE COMPUTER FOR $1995.



*Introductory Price

CHAMELEON

by Seequa

SCREEN

- Large 9-inch display
- Full width of 80 columns
- Depth of 24 lines plus extra status line
- Green phosphor characters

CPU: Z-80A

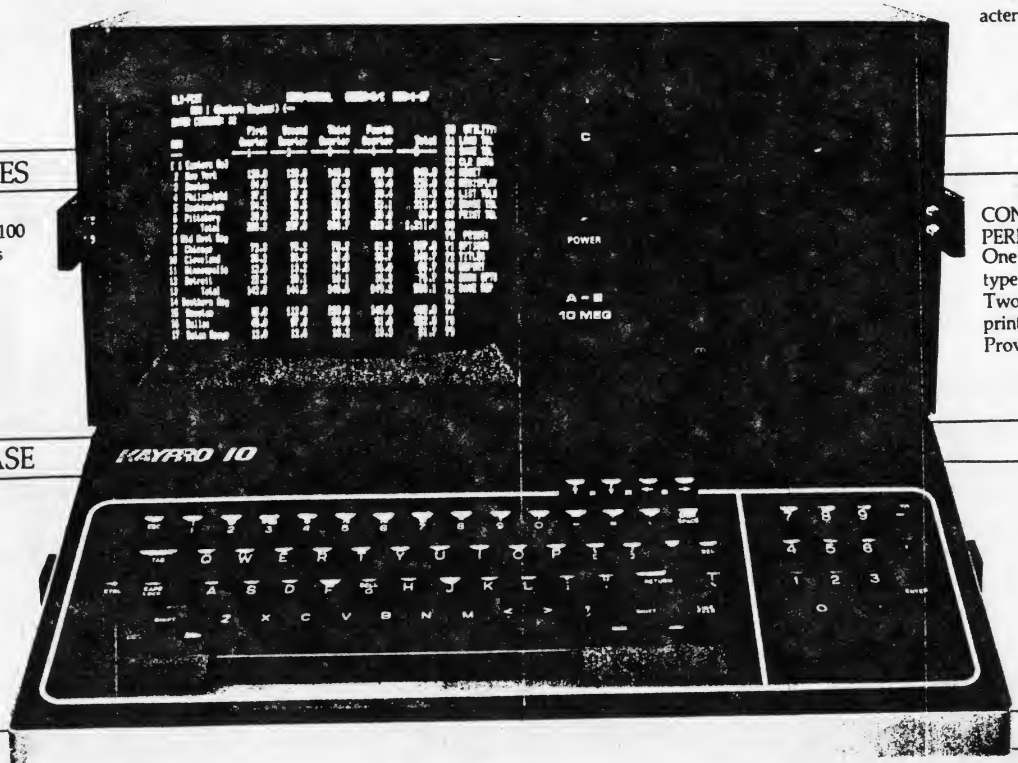
RAM: 64K BYTES

DISK DRIVES

5¼" double-density, floppy disk
Disks from KAYPRO II are compatible.
Winchester® drive for increased storage — holds 10 megabytes (10 million characters) — equivalent to 50 floppies!

VIDEO FEATURES

- Graphics mode with 160 x 100 pixels for graphs and games
- Inverse
- Blinking
- Underlining
- Reduced intensity



INPUT / OUTPUT

CONNECTIONS FOR OPTIONAL PERIPHERALS:
One parallel port with "Centronics"-type interface for parallel printer
Two RS-232C serial ports for serial printer and modem
Provision for light pen connection

COMPUTER CASE

Portable
Self-contained
Low-profile
Metal
Carrying handle
Detachable keyboard

CONTROLS

- Brightness adjustment
- Reset button
- Power rocker switch

KEYBOARD

Stylized typewriter keyboard with cursor movement keys
14-key calculator-type numeric keypad with keys which are also programmable

OPTIONS

Weatherproof, vinyl carrying case
Padded, nylon carrying case

THE 64, QUITE SIMPLY, HAS NO COMPETITION. AS A QUICK LOOK AT OUR COMPETITION WILL TELL YOU.

Features	COMMODORE 64	APPLE II+®	IBM® PC	TANDY TRS-80® III	ATARI 800®
Base Price*	$595	$1530	$1565	$999	$899
Advanced Personal Computer Features					
Built-in User Memory	64K	48K	16K	16K	16K
Programmable	Yes	Yes	Yes	Yes	Yes
Real Typewriter Keyboard	Yes (66 keys)	Yes (52 keys)	Yes (83 keys)	Yes (65 keys)	Yes (61 keys)
Graphics Characters (from Keyboard)	Yes	No	No	No	Yes
Upper and Lower Case Letters	Yes	Upper Only	Yes	Yes	Yes
5¼" Disk Capacity Per Drive	170K	143K	160K	178K	96K
Audio Features					
Sound Generator	Yes	Yes	Yes	No	Yes
Music Synthesizer	Yes	No	No	No	No
Hi-Fi Output	Yes	No	No	No	Yes
Video Features					
TV Output	Yes	Extra	Extra	No	Yes
Input/Output Features					
"Smart" Peripherals	Yes	No	No	No	Yes
Software Features					
CP/M® Option (Over 1,000 Packages)	Yes	Yes	Yes	Yes	No
Game Machine Features					
Cartridge Game Slot	Yes	No	No	No	Yes
Game Controllers	Yes	Yes	Yes	No	Yes

*Manufacturer's Suggested Retail Price July 1, 1982. Disk drives and printers are not included in prices. The 64's price may change without notice. And, after they get a look at this chart, you can count on the competition to change their prices.

WITH A COMPUTER THAT'S LIGHT YEARS AHEAD OF ITS COMPETITION, WE THOUGHT IT APPROPRIATE THAT ITS SOFTWARE SHOULD BE AT LEAST A FEW YEARS AHEAD.

Here's how we did it.

PART I. THE FIRST ORDERLY APPROACH TO SOFTWARE.

Commodore's programmers examined the whole jungle of software available today—literally hundreds of programs—and isolated the most popular and most useful.

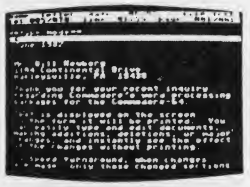
Then they made them better. The result: a variety of highly refined, perfected programs for home, business and education.

PART II. AN ALMOST INFINITE ARRAY OF SOFTWARE.

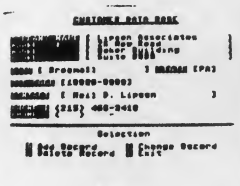
Independent makers of software have already hopped on the 64 bandwagon. They've come to Commodore for training on the 64 and are adapting the world's most popular programs to the 64.

Further, the 64 is compatible with CP/M.® Which means a simple optional add-on opens up over 2,000 additional useful programs.

Plus—and a big plus this is for educators—you can also have access to programs developed for the Commodore PET,® as it uses the same BASIC language as the Commodore 64.



WORD PROCESSING



DATA BASE

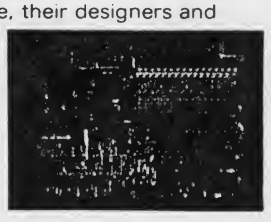
ELECTRONIC SPREADSHEET

WHY DID THE 64 COME FROM COMMODORE AND NOT SOMEBODY ELSE? BECAUSE WE MAKE OUR OWN CHIPS.

Commodore is one of the few companies that design and manufacture their own chips.

So, unlike other computer companies that have to buy their chips, when Commodore wants to alter a design or create a new one, their designers and engineers work hand in hand.

The result: a lot more computer for a lot less money.



CP/M® is a registered trademark of Digital Research Inc. Optional Z80 microprocessor required.

Section 12

Acquisition Checklist

The Economics of it all

By now you're probably ready to run down to your local computer store, plunk down your money and carry your system home. Well don't! Not at least until you've read this section. In it I'll give you some info to make your purchase a little easier and maybe even save you some money.

Once you've chosen the word processor, the next step is figuring out the best deal. That is, should you purchase, lease, or rent? Let's look at the advantages and disadvantages of each. Then I'll tell you what to look for in the fine print of the contract you'll be signing.

Purchasing

Purchasing your system offers numerous tax advantages if you have a small business or are self-employed. It qualifies you for an investment tax credit. In addition, if you borrow to finance the purchase you can deduct interest payments from your taxable income. Not only that, but the total value of the equipment can be depreciated over a 3-5 year period. Tax laws keep changing, so check with an accountant or one of the tax guides to figure how much you can save.

On the other hand there are some disadvantages to buying a word processor. First, word processor and computer technology is rapidly improving so you risk being stuck owning an old fashioned, obsolete model. Top of the line word processors of two years ago are really primitive compared to even today's low cost systems. And there's no reason to expect this trend to change. Second, if you're not absolutely sure what type of system you'll ultimately need, you could find yourself stuck with an inappropriate machine. Third, because the price of computer equipment keeps dropping you will find that whatever you buy today will be available tomorrow at a much lower price. Computer technology is one of the few commodities that keeps ahead of the inflation rate. Fourth, unless you borrow the funds, you'll have to tie up capital in the purchase. But, compared to the high cost of renting, the tax advantages of buying make it an attractive option.

Leasing

Leasing may appear to be the best of all worlds. You won't have to tie up much cash, because leasing requires prepayment of only a few monthly installments. Leases usually run from 3-5 years with an option to purchase the equipment at a additional cost at the end of the term. This gives you the advantage of buying through installments with the last payment five years down the

line all at today's prices. The disadvantages are, the machine winds up costing more than if you buy it outright and, as I mentioned earlier, the price of computer equipment keeps dropping. Also, leases are extremely difficult to get out of, and "full payment leases" pretty much guarantee the lessor a substantial profit and the tax advantages of equipment ownership as well. The lease may or may not include a maintenance contract. It's important to check this out because maintenance can cost a bundle.

From a tax perspective several leasing options are possible. The lease may be considered either a true lease or a conditional sale. Under the terms of a conditional sale, part of the monthly payments can be deducted as interest, and because the conditional sale eventually results in ownership, the investment tax credit and depreciation benefits are also available. Under a straight lease arrangement, the company leasing you the equipment maintains ownership and receives the tax break which may or may not be passed on to you under the terms of the lease. Leasing would be advantageous to smaller companies or individuals who are not making enough money to require a tax shelter or might have difficulty obtaining financing for the purchase of a word processor.

Renting

When you lease or purchase you're making a long term commitment to a particular piece of equipment. If you rent, on the other hand, you'll have time to try out a system or to complete a critical project on a short term basis. Renting costs much more than buying or leasing, but you can deduct these costs from your taxes if you're using the word processor for business.

Beware! If you decide to rent, pay close attention to the length of the rental period and the amount of notice you must give to terminate the contract. Some rental agreements are automatically renewed if you move like a turtle and are too slow in notifying the company of your intention to terminate.

Buying and Selling Used Equipment

Look in the classified section of any large urban newspaper for listings of personal or small business computers, and word processors and you'll see that a vast market has been developing for the purchase and sale of used computer equipment. Many of these ads, unhappily, are placed by people who did not read this book and purchased the wrong equipment for their word processing needs. But many older or used systems which have been replaced by newer and faster models still work well because the electronic portions of the system have no moving parts to wear out. They can be excellent buys. I have seen current model used machines being sold for 50-70% of their new price. If the

classifieds don't have what you've been looking for, there may be an organization in your area which brings prospective buyers and sellers together for a modest fee; a sort of computer matchmaker. Before buying a used system it's important to check if the machine is still being serviced and supported by the manufacturer. If not, don't buy it!

I always wind up buying used computers because of the money I save. But then, that's my style. I purchase most of my things used. The classified ads are my favorite section of the newspaper. But to purchase used equipment you must have ready cash. You may have trouble trying to convince a bank to lend you money for a used computer advertised in the paper. Banks don't accept personal computers as collateral yet.

Contracts

Buying or leasing a word processor can be a lot more complicated than buying or leasing a TV or a microwave oven. I suggest that you sign a contract with the vendor you get your system from. Now I'll tell you what makes a good contract.

A successful contract, is one that no one ever bothers to look at after it is signed. It just gathers dust in some drawer because each of the parties is in complete agreement about their mutual responsibilities. An unsuccessful contract, on the other hand, leaves at least one of the parties constantly reading and rereading it, quoting sections as a threat to the other. Not too much fun. Computer and word processing vendors have extremely well-written standard sales contracts for hardware and software. But because their lawyers wrote the contract it protects them and doesn't offer you a thing in the way of protection. Show this contract to your lawyer before signing it! A lawyer's fee is an inexpensive insurance policy for the money you're going to lay out. I suggest adding some of the items listed below to the contract before you buy - not only for your legal protection, but as a sincerity test for the vendor. If all the vendor's promises and claims are true, he or she should not object to putting them in writing. Still, quite a few vendors do refuse to put their promises in writing. If this happens look elsewhere for your machine!

The following things should definitely be discussed with the salespeople. Try to get them to agree in writing to as many of them as possible. Unless you're a whiz at negotiating you probably won't get everything you want. But the process should help you clarify exactly what you'll be getting when you buy the system. In other words, it is a way of assuring that you and the vendor are on the same wavelength.

Specifications

The system specification section of the contract should contain a list of:

1) All the physical equipment (hardware) you'll be purchasing including a detailed description of each part with it's model numbers. And don't forget the connecting cables.

2) A list of all software including version number to be supplied and your rights regarding their use. (see chapter 7 on software licenses)

3) The storage capacities for the machine's memory and disk drives.

4) All manuals to be supplied with the system as well as any educational materials or classes to be provided.

If you can, include the promised upgrade possibilities, such as being able to support more than one word processing station, and the cost of each upgrade. Then, and this is very important, include a list of the functions you expect the word processor to perform. For instance, if you were told the word processor would automatically backup your files, include that in the contract. You want to avoid buying a system you've been promised has certain capabilities and then finding you have to spend more money on additional equipment or software to get it to perform these functions.

If possible, insert a clause stating that you have relied on the vendor's expertise in purchasing your system. This could afford you additional protection if your purchase turns out to be a complete disaster.

Payment Terms

If you are purchasing, be sure your contract states the total purchase price of the system. This price should include the costs of hardware, software and installation. Before signing, be sure that you and the vendor are in agreement that there will be no additional costs over what's stated in the contract.

If you've decided to lease the system make sure the contract clearly states the following:
1) Payment due dates and late payment penalty charges.
2) Cancellation notice requirements and penalties.
3) Clearly defined purchase provisions for the end of the lease
4) Who owns the hardware and software.
5) And, if possible, provisions for costs and options to upgrade the system to a more advanced model during the lease period.

Maintenance and Warranty

Here's where you have to polish your magnifying glass. Whatever it takes, please read the warranty carefully! The warranty period for a word processor is usually 90 days and covers complete replacement or repair of any malfunctions during that period.

In addition to that warranty, the contract should clearly spell out who will be responsible for repairs after the warranty period is up. What is the expected turn-around time for repairs and who pays for it? It is frustrating to be forced to wait while parts for your machine are being shipped across the country for repair.

A year's maintenance contract typically costs about 12% of the total hardware cost. It should specify whether the technician makes house calls or if you must haul the equipment back to the shop for repairs. Most maintenance contracts provide a replacement machine so you won't be without a working system for more than two days.

The contract should also cover software maintenance and the cost of updates. Most popular software packages don't have many problems because all of the bugs have been worked out by hundreds of users. But problems do occur and you should protect yourself against that possibility. Also check the cost associated with software improvements or upgrades to your system.

Delivery and Installation

Your contract should contain the delivery and installation dates and specify that before the final payment is made, a series of tests will be run to make sure that the equipment is operating correctly.

Smaller systems are usually tested by the retailer at the store. Make it a point to be present during the testing, and you'll get a free lesson in how to set up and operate your machine. If you can't be there, at least get the salesperson to show you how to set it up yourself.

Larger systems are usually installed and tested at your office. Make sure that the contract clearly states this and specify that you want the system to be working without a hitch before the installation person gets away.

Insurance

Those of you who work at home might find that your standard household insurance policy does not cover a computer used for

business. In addition, many business policies consider a computer to be a fancy typewriter. Check what your policy does and does not cover. Computer insurance policies are available for $100 - 200 and will protect you and your machine from problems caused by accident, theft, or vandalism. Make sure that your software is also covered by the policy. There is even a policy that insures you against the accidental erasure of data or text files.

Disclaimer

I included this section on contracts merely as a guide. Don't use it in place of advice from a lawyer. Contracts must include items like legal recourse, liability sections and other things that only lawyers are qualified to deal with. So have a lawyer go over the contract before you sign it. Then you both can check the fine print and add some of your own to protect your investment. In other words make sure you cover your assets!

from: Word Processing and Beyond
by : Fred Stern
Published by John Muir Publishing Co. 1983

Section 13

Human Factors

Ergonomics

A field of study devoted to the working relationship between people and machines.

It addresses the design of machines and the workspace to promote health, safety, comfort and productivity.

VDT Health Factors

- Ergonomics
- European Standards
- NIOSH report (1980)
- Newspaper Guild Study
- The Problems
  - Eye Strain
  - Head Aches
  - Back and Muscle Aches
  - Stress
- The Causes
  - Environmental Lighting
  - Reflective Glare
  - Direct Glare
  - Equipment Design
  - Furniture Design
  - Environmental Conditioning
  - Job Design

NIOSH Report (1981)

- Radiation not a Problem
- Work Station Design
- Adjustable Furniture
- Lighting and Illumination Standards
- Glare Reduction
- Equipment Design
- Rest Breaks
- Vision Testing

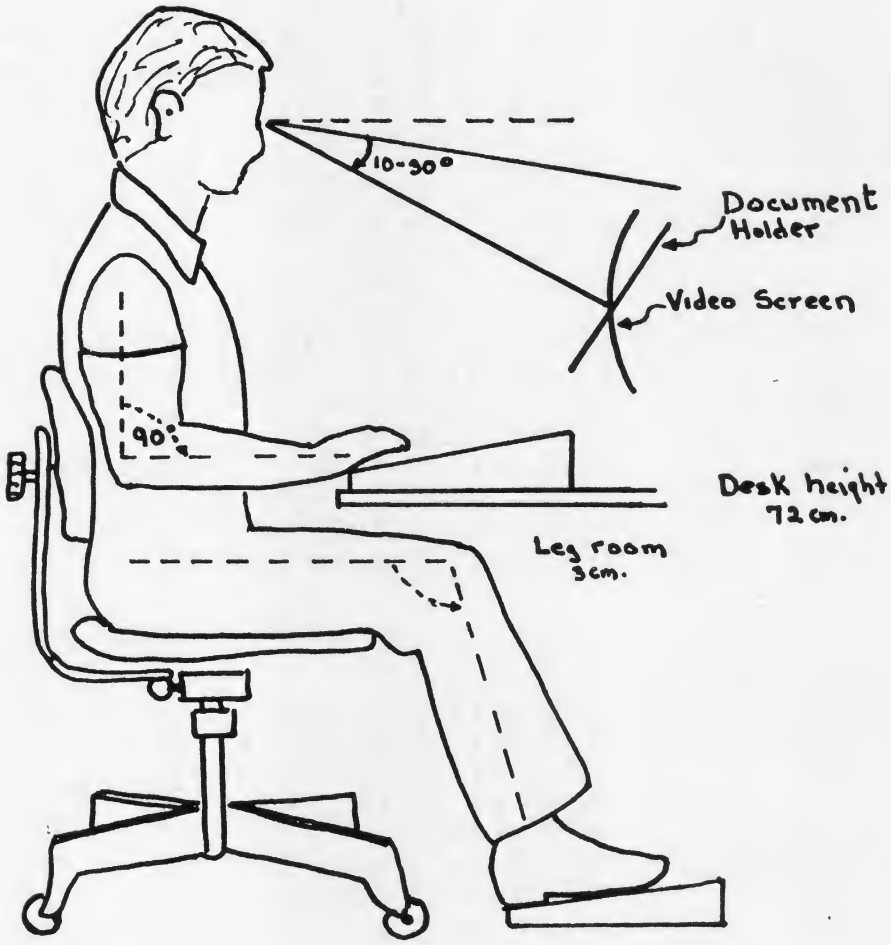
Human Factors Background

- Ocular Anatomy
- Lighting Factors
  - Illumination
  - Luminance
  - Reflection
- Lighting Levels
  - Normal Office
  - VDT Levels

50-70 FCandles
Normal 200

- Lighting Quality
- Sound Levels
- Muscle Problems

Posture Requirements



Ergonomic Checklist

Equipment

- o Anti Glare Screen
- o Tiltable Screen
- o Image Intensity Controls
- o Green or Amber Display
- o Crisp Characters
- o Character to Background: 5:1
- o Flicker Free
- o Dot Resolution: 7x9
- o Character height: greater than 3mm.
- o Horizontal and Vertical Scrolling
- o Screen Capacity: 1920 characters
- o Highlighting
- o Blink Capability
- o Cursor Readability
- o Multiple Character Sizes
- o Detachable Keyboard (3 ft. cable)
- o Sculpted Keys
- o Matte Finish
- o Keyboard Angle (5-15 degrees)
- o Click Sound When Key is Pressed
- o Function Keys
- o Keyboard Arrangement

Chairs

- o Adjustable Seat
- o Slightly Concave
- o Adjustable Backrest
- o Swivel with Lock
- o 5 Casters
- o Forearm Support
- o Porous Padding
- o Foot Rests

Ergonomic Checklist (cont.)

Desk

- o Adjustable Desk Height
- o Adjustable Keyboard Height
- o Adequate Work Area
- o Adjustable Viewing Distance
- o Document Holders
- o Sufficient Leg Space

Lighting

- o Illumination: 30-50 footcandles
- o No Direct Glare
- o Direct Field Lighting: 3:1 Over Screen
- o Peripheral Lighting: 10:1 Over Screen
- o Indirect Lighting
- o Universal Fluorescent Lights
- o Install Ballast Dimmers
- o Auxilliary Desk Lamps
- o Furniture Placement
- o Shades or Blinds on Windows

Sound

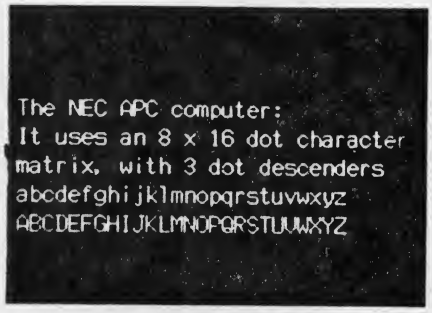
- o Noise Level Less Than 55 db.
- o Free From High Frequency Noise
- o Printer Sound Shields

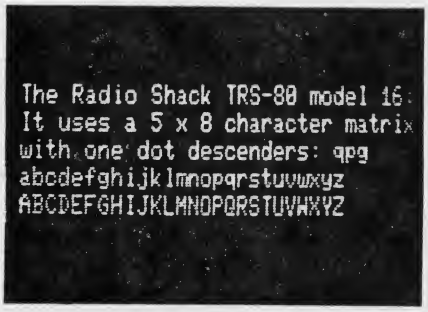
Operating Procedures

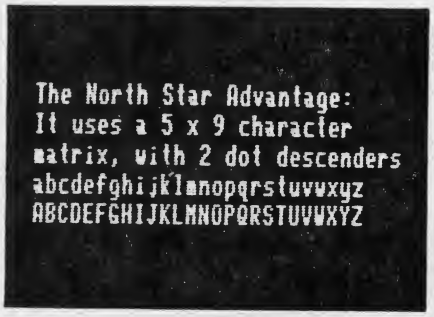
- o 15 Minute Break Every Hour
- o Periodic Eye Examinations
- o Relaxation Exercises
- o Periodic Equipment Adjustment
- o Anti Static Measures
- o Training

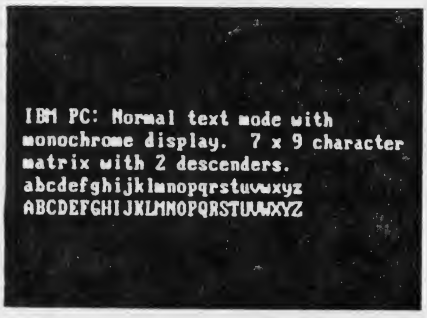
3:1 Dawning on a mix

Screen Comparisons









Section 14

Environmental Considerations

Power Considerations

- Proper Outlet Grounding
- Dedicated Lines
- Voltage Problems
  - Spikes
  - Surges
  - Brown Outs
  - Black Outs
  - Electromagnetic Interference
- Line Filters
- Voltage Regulators
- Isolation Transformer
- Uninterruptable Power Supplies
- Static Electricity
  - Anti Static Sprays
  - Grounding Mats

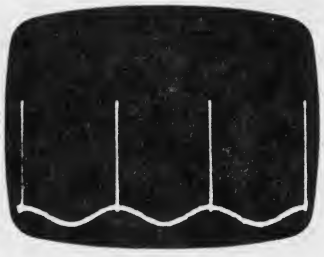
Environmental Conditioning

- Lighting
- Furniture
- Cabling
- Sound
- Temperature
- Dust
- Humidity

20 Commandments of Floppy Disk Care

1. THOU SHALT NOT touch or clean the magnetic surface of the disk.
2. THOU SHALT only use high quality disks that sound and run smoothly.
3. THOU SHALT NOT force a disk when inserting it into the drive.
4. THOU SHALT NOT smoke, eat or drink while handling disks.
5. THOU SHALT NOT place objects on disks.
6. THOU SHALT NOT attach paper clips or rubber bands to disks.
7. THOU SHALT NOT store or place disks in sunlight or near excessive heat.
8. THOU SHALT NOT fold, bend or mutilate disks.
9. THOU SHALT NOT write on a disk with a ball point or pencil.
10. THOU SHALT NOT expose disks to magnets or magnetic field.
11. THOU SHALT always return a disk to its protective envelope after use.
12. THOU SHALT discard damaged or contaminated disks.
13. THOU SHALT store disks in a vertical position in a disk case.
14. THOU SHALT remove disks from drives after use.
15. THOU SHALT only use the reverse side of floppy disks for backup
16. THOU SHALT clean the disk drives at fixed periods.
17. THOU SHALT always back up important disks.
18. THOU SHALT NOT use disks where there's excessive dust, heat or moisture.
19. THOU SHALT use write protect tabs.
20. THOU SHALT check problem disks with a disk verification program.

Stops high voltage transients before they can do any damage



This oscillograph shows a typical 120 volt power line being hit by a 2,000 volt surge. Even though the surge is of short duration (approximately 20 μ sec.), it is capable of doing severe damage to sensitive electronic equipment.

Surges Can Be Very Destructive

Today's small computers, communications, medical and other sophisticated electronic equipment are extremely sensitive to even low-level voltage transients. A voltage surge lasting less than one millisecond can result in misindexed programs, false triggering of circuits, premature component failure, hazardous shorts, or even an electrical fire due to arc-over.

Surges Cannot Be Prevented

Since voltage transients are caused by such things as down line lightning hits, inductive load switching and physical shock to power lines, power companies have *no practical means of preventing them.* In fact, as shown in the chart below, the typical commercial line in the United States can expect to receive an average of 2,000 or more power surges *each year.**

United States Average

Transient Surge Voltage	Frequency of Occurrence Per Year
5,000 V	1
2,000 V	10
1,000 V	50
400 V	2,000

In areas which experience lightning strikes, transient surges up to 20,000 volts are not unusual.

Although the power line is still being hit by high voltage transients, the oscillograph shows a Surge Sentry is now detecting and shunting them in picoseconds.

Rapid Response Protection, High Energy Dissipation

All Surge Sentry models are easy to install. No complicated wiring is required and, once in place, Surge Sentry constantly monitors incoming voltage for transients. When a surge is detected, the unit responds in picoseconds. What's more, Surge Sentry has the ability to clamp any voltage rise of more than 15% above peak nominal. Rated dissipation is 1,000,000 watts at 100 microseconds.

Works in Parallel, Not Load Bearing

For added protection, the Surge Sentry *works in parallel with the power line and is not load bearing.* So, even if the unit stops working (which is highly unlikely), your equipment will continue to operate unharmed. In addition, all components are U.L. recognized, and the Surge Sentry has a neon light which tells you, at a glance, that the unit is working properly.

*Source: "Preventing damage from transients," an article by Carl Babcoke, CET, *Electronic Servicing* (February, 1980).

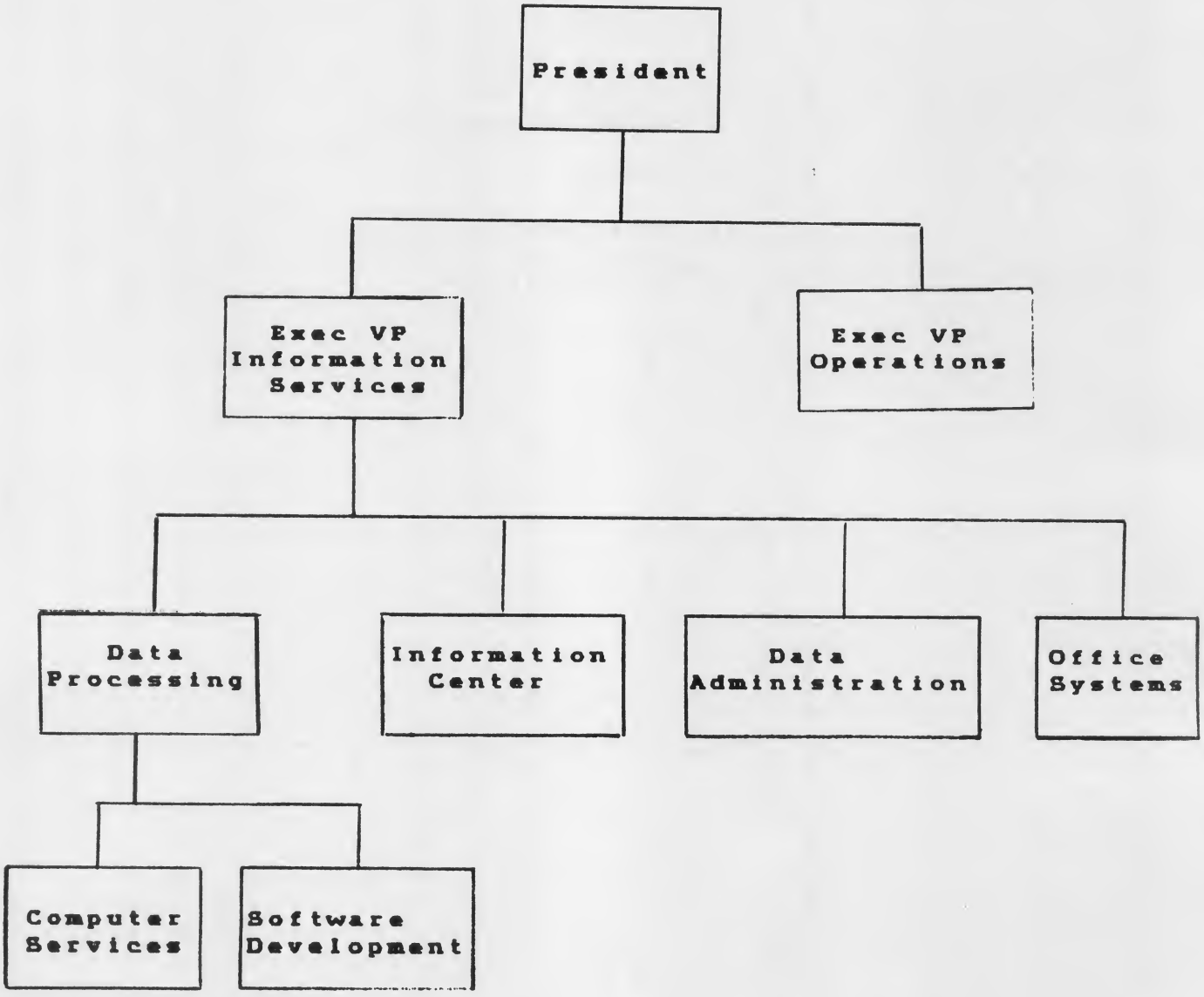
Section 15

Organizational Policies

Who Controls Personal Computers

- Data Processing
- Users
- Management
- Uncontrolled

Organizational Structure



Introducing Personal Computers

Why?

- They Are There Already
- Will Be There in the Future
- Distribute Processing
- Distribute Data
- Prototyping
- Management Tool
- Precursor to Office Automation

Introducing Personal Computers

How?

- Policy Task Force
- PC Software Classes
- Distribute - Monitor Applications
- User Groups
- Employee Discounts

Personal Computer Task Force

- Analyze Requirements
- Evaluate
  - Applications Software
  - Operating Systems
  - Hardware
  - Communications
  - Networking
- Vendor Evaluation
- Select Suppliers
- Determine Purchasing Guidelines
- User Training and Consulting
- Software Development Standards
- Operating Procedures
  - Data Security
  - Data Integrity
- Ergonomic Requirements
- Environmental Conditioning
- Required Supplies and Sources
- Publish Policy Document

Personal Computer Policy Document

- Purpose of Document
- Scope
- Definition of Terms
- Acquisition and Purchasing Guidelines
- In-house System Support
- Licensing Requirements
- Security
- Data Integrity Issues
  - Uploading and Downloading
- Applications Supported
- System Requirements
  - Application Software
  - Operating Systems
- In-House Development and Standards
  - Hardware
  - Communications
    - Interfaces
    - Protocol
    - Networking
- Approved Vendor Lists
- Service and Maintenance
- User Training
- Environmental Considerations
- Required Supplies

Section 16

The Future

Appendix

Glossary of Terminology

Acknowledgement - The process of informing the sending node that a message has been received correctly.

Acoustic Coupler - An electronic device that converts data signals into tones that can be transmitted over the phone lines using a standard telephone handset.

Application Program - The reason you purchase a computer.

Arithmetic Unit - The section of the processor that contains circuits to do arithmetic.

Alphanumeric - A term used to describe the combination of alphabetic (A-Z) and numeric (0-9) information.

ASCII - Electronic standard for transmitting text. The computer's version of Morse code. ASCII stands for American Standard Code for Information Interchange and is widely used for data transmission.

ASCII Capture - Saving the complete dialogue of a data communication instruction.

Assembler - A computer program that translates assembly language into machine language.

Asynchronous Communication - A mode of transmitting data between two computing devices, one character at a time.

Backup - A procedure for making copies of important documents or files on either diskettes or tape. This enables recreation of the files if the originals are lost, stolen or damaged.

Bandwidth - The information carrying capacity of a communication channel.

Baseband - The frequency band occupied by the information signal. Baseband signalling implies a network using a single digital signal.

Basic - An algebraic-like programming language.

Batch - A form of data processing where transactions are accumulated for a period of time before processing is started.

Baud - The number of discrete signal events per second. The rate of signal change on a comunications line.

Bidirectional Printing - A means of increasing printing speed by printing odd lines going from left to right and even lines from right to left.

Bisynchronous - A synchronous half duplex multidrop protocol used on IBM mainframes for data communications.

Bit - The basic unit of information for storing and transmitting data. Also called a binary digit, it has a 0 or 1 state.

Bit Rate - The rate at which bits are transmitted over a comunication line. The speed in bits per second

Block - A group of characters, bytes or words transferred as a unit. A block check character is appended to check the block integrity.

Broadband - Transmission on high bandwidth medium, usually multiplexed to form a series of information channels.

Bubble Memory - A recent development for storing large amounts of information. Slower than RAM, faster than disk.

Bulletin Board - A communication program enabling the sending and receiving of messages.

Bus - A multiwire cable for transmission between microcmputer components.

Byte - A unit of computer storage equivalent to 8 bits or one character.

Capacity - The number of characters or bytes that can be stored on a diskette or the amount of memory available. Usually expressed in thousand bytes (k bytes).

CBX - Computer controlled branch exchange.

CCIT - European international standards group - Consultative Committee for Intertational Telephone and Telegraph.

Cassette - A cartridge of magnetic tape resembling an audio tape cassette. Used for data and program storage.

Character - A single piece of printed information. The character alphabet consists of letters (A-Z) and numbers (0-9) and special symbols (:@$%&*).

Character Generation - The technique used to create characters on the display screen or printer. The characters are composed of a series of dots.

Clock - A repetitive control device used to control operations in a computer.

Cluster - A grouping of terminals or processors connected to a common computer or communication device.

Coaxial Cable - Cable with a single center cable surrounded by a woven wire shield. Used for connecting terminals and processors for high speed communication purposes.

COBOL - Common Business Oriented Language. The major business programming language. COBOL is to business what Hebrew is to religion.

Collision - Two processors attempting to transmit simultaneously on a network.

Common Carrier - A government regulated private company supplying the general public communications facilities.

Compiler - A program used to convert higher level language instructions into machine language.

Concurrent Operating System - Controlling a computer to accomplish simultaneous multiple tasks for a single user, also called multitasking.

Contention - Competition between devices for the same communication facility.

Copy - The process of copying a file from one physical disk to another.

CP/M - Control Program Monitor developed by Digital Research. The most popular operating system for small scale computers.

CPS - The speed at which a printer can print. The number of characters printed in one second.

CPU - Central Processing Unit. The heart of a computer - controls the interpretation and execution of instructions.

CRC - Cyclic Redundancy Check. To check correctness of block data transmission.

CRT - An abbreviation for Cathode Ray Tube. The TV-like display used by computers and television sets to display

information.

CSMA/CD - Carrier Sense Multiple Access with Collision Detection - contention protocol.

CTS - Clear To Send. An RS232 function to signal a modem or DTE that it's ok to send information.

Cursor - The means of indicating the present position on the CRT. Usually indicated by a blinking square or underline. It can be moved around the screen by the directional arrow keys.

Daisy Wheel - A type of print element used in letter quality printers. The daisy wheel has a character imprint on each petal and is rotated and impacted to print a character

Data Base - A collection of computerized data files organized so they can be used for multiple applications.

Data Base Management System - An applications system allowing storing, updating retrieval of information and the generation of reports from a data base.

Data Compression - A technique to reduce the space required by data or program files.

Data Processing - A term to mean business or commercial computer processing.

Data Rate - The rate at which a data channel carries data.

DCE - Data Communications Wquipment. Equipment establishing a communication line. A modem or CIU.

Debugging - Removing problems from a program.

Decryption - The opposite of encryption. The recovery of encoded messages to original form.

Dictionary - A file of words used by the system to assist in the correction of spelling errors.

Directory - A list of all documents stored on a disk file.

Disk Drive - A storage device used for holding electronic representation of text or of data files capable of random access.

Diskette - (or Floppy Disks) Magnetic coated flexible plastic disks capable of storing between 100k and 1 meg bytes of information.

Distributed System - Dividing the computing tasks up between a series of computers.

Dot Matrix - A method of generating display or printed characters formed by a grid of dots.

Dot Matrix Printer - A means of printing by firing pins against a print ribbon creating a character image.

DTE - Data Termination Equipment. Data send or receive equipment normally connects to a DCE.

Dumb Terminal - A terminal that can only send or receive information. A smart terminal has processing and storage capability as well.

Echo Mode - A means of data transfer in which the host echoes received information back to the sender.

Edit - Changing the contents of a document or file by adding, removing or rearranging information.

EIA - Electronics Industries Association established RS232-C standard.

Electronic Mail - The transfer of documents over an electronic network to other word processors or computers.

Elite Type - A type face printed with 12 characters per inch.

Encryption - Coding information for security.

Ergonomics - The design of equipment for operator comfort and safety.

Ethernet - A LAN developed by Xerox, supported by Intel and DEC.

Fibre Optics - High bandwidth transmission medium for optical data transmission.

Field - A unit of information within a record.

File - A collection of records stored on magnetic storage medium.

Floppy - See diskette.

Font - The type style available for printing. A description of style and size.

Fortran - Formula Translation. A programming language for scientific applications.

Formatting - The initializating of a disk for use by a computer system. Formatting a disk erases all information that was on a disk.

Fourth Generation Language - A program that transforms a computer into a useful tool for non-programmers.

Frequency Division Multiplexing - A technique for transferring data from multiple sources on to a single communication line by dividing the frequency bandwidth.

Friction Feed - A means of feeding single pages to a printer by friction rollers in contrast to a sprocket drive.

Full Duplex - Data transmission in both directions at the same time.

Function Keys - Additional keyboard keys for carrying out special functions.

Gateway - Equipment designed to connect two or more dissimilar networks.

Half Duplex - A communication mode with transfer in one direction at a time.

Handshaking - Preliminary signal transfer between communicating elements to verify that communication has been established.

Hard Disk - A high capacity data storage device capable of megabytes of off line storage.

Hardware - Physical computer equipment. The processor, storage, printer, etc.

Hertz - (Hz.) Measurement of frequency same as cycles/sec.

Highlight - A means of emphasizing a portion of text by outlining or reverse video.

Horizontal Scrolling - Ability to move text horizontally across the screen to work with material whose width is greater than the screen width.

Impact Printer - Any printer that forms a character by forcing an imprint mechanism against a ribbon striking the paper.

Information Processing - Combined word and data processing

Ink Jet Printer - A non-impact printer that shoots small droplets of ink at the paper to create characters.

Input - The data to be processed, transferred from keyboard or external storage

Install - The process of modifying an application program to work with a terminal or printer.

Intelligent Terminal - A terminal with send receive, processing, and storage capabilities.

Intercharacter Spacing - The spacing between characters, a fixed value for all printers except proportional ones in which the spacing varies with the size of the character printed.

International Standards Organization - ISO responsible for OSI model.

Interpreter - A type of compiler that performs the translation and execution of a high level language in one step.

Justification - The alignment of all text lines so that they are flush with both the left and right margins.

Keyboard - The portion of a computer that is similar to the typewriter, containing electronic keys for entering information.

LAN - Local Area Network. A communication network operating over a limited area.

Lease Purchase Plan - See conditioned sale.

Leased Line - A private communication line leased from a common carrier.

Letter Quality Printer - High quality printer that creates a printed copy as good as that produced on an electric typewriter.

L.P.M. - The speed of a printer. The number of lines that it prints in one minute.

Mega - Refers to one million. 10 meg of storage can hold 10 million characters of information.

Menu - A means to choose between alternative available options. Usually displayed as a numbered list.

Microcomputer - A microprocessor based computer including memory, I/O, and logic.

Microprocessor - The central unit of a microcomputer that contains the control and logic portion of a "computer on a chip".

Microsecond - One millionth of a second.

Mini Diskette - A 5 1/4" diskette capable of storing 100k - I megabytes - of information.

Modem - Also known as a data set to enable systems to communicate over the phone line. A computer's telephone.

NAK - A communication control character indicating a message is rejected due to a transmission error.

Network - A computer communication system linking a series of computer elements.

OEM - Original Equipment Manufacturer of a computer system or one of its component parts.

Operating System - The control program handling all housekeeping functions required by the applications program. The behind-the-scenes technical crew. Operating systems can be single user, multi-user, and multitasking.

Output Device - A device used to transfer information.

Parity - The setting of a bit to check that information has been transferred correctly between two devices.

Parallel Interface - Simultaneous transfer of all the bits making up a byte. Requires eight wires.

PBX - Private Branch Exchange. Telephone switching system.

Peripheral - Any device that is attached to a computer. Printers, disk drives, and modems are peripherals.

Photocomposition - A process for producing camera-ready copy containing multiple character fonts and sizes. The copy is created either through the use of a graphic display screen or through projected optical processes.

Pica Type - Ten pitch; a print size of 10 characters per inch.

Pin Feed - Paper movement relying on special holes on the sides of the paper. Usually used in the printing of draft copy.

Pitch - The number of characters per inch printed horizontally. Ten pitch or 10 characters per inch is called Pica.

Plasma Display - A thin screen non-CRT display device.

Printer - A device used to print text on paper.

Print Wheel - See daisy wheel.

Processor - The heart of the computer. See central processor.

Program - A set of instructions run by a computer to transform it into a useful tool.

Prom - Programmable Read Only Memory. EPROM, is erasable ROM and can be altered by exposure to Ultra Violet light.

Prompts - Short messages to assist the user in what to do next.

Proportional Printing - The size and spacing of characters is set to be proportional to the size of the character printed. Both software and the printer must support this feature. The resulting copy is very print like.

Protocol - The formal control information required if two computers are to communicate with each other. A set of rules for the exchange of information between communicating elements.

RAM - Random Access Memory or Storage. A measure of the storage space available in the computer. Specified in kilobytes, otherwise known as thousands of characters. RAM memory is erased every time the power is turned off.

Record - A data item composed of a series of subsets or fields.

Refresh - The process of repeatedly restoring the contents of a memory or display device.

Rent Purchase Plan - A rental agreement in which a percentage of monthly rental payments can be applied to equipment purchase.

Reverse Video - Display of text in reverse color for emphasis. If a screen is displaying text in white on black, highlighted portions would be in black on white.

Ribbon - Inked cloth or carbon film used to create

printed image on paper.

Ring - A communication network in which all terminals are connected in a loop arrangement.

ROM - Read Only Memory. A portion of memory where programs and control information are stored. ROM memory is not erased when the power is turned off.

RS-232C - A common type of connection for attaching a computer to printers, modems, and other peripherals.

Scrolling - A means of viewing more information than will fit in the VDT window at one time. The information can be scrolled both horizontally and vertically.

Serial - A method of communication between two computing devices in which a single bit of information is sent at a time. Parallel communication sends one character or byte at a time.

Shared Resource - A word processing system where several users share peripherals, such as a printer and disk storage.

Sheet Feeder - A printer attachment to feed single pages to a printer.

Software - A term used for programs and documentation that establish the machine personality. Programs are kept on the systems disk and loaded into the machine for use.

Source Code - The computer code in a higher level language, before compilation.

Standalone System - A complete word processor or computer containing a VDT, small computer, printer and, of course, software.

Super Micro - A microcomputer using a 16 or 32 bit processor.

Synchronous - Computer communication in which data is transmitted as blocks of characters. Synch controls are placed at the beginning and end of each block.

Telecommunications - Communication between computers using the telephone lines.

Terminal - See VDT.

Text Editing - A program for working with written text. Originally referred to software for editing computer programs, recently has become synonymous with word processing.

Thermal Printer - A non-impact printer which uses a heat sensitive page.

Time Division Multiplexing - A time sharing technique for interweaving the communications from several users onto a single communication line.

Time Sharing - The sharing of power and cost of large computer facilities among a number of users by giving each small time segments or slots.

True Lease - A lease arrangement in which the ownership of the equipment remains with the lessor. This makes monthly payments a tax deductible expense.

Unix - The most widely used minicomputer operating system.

User Friendly - A term that every computer and software vendor uses to describe their products.

Utilities - A series of programs used to perform support operations for auxiliary disk functions. Copying disks for backup is a utility function.

VDT - Video Display Terminal. A combination of video display screen and keyboard.

Vendor - A company that supplies computer equipment or supplies.

Voice Grade Line - A term applied to a telephone line with a 3000 Hz bandwidth for transferring voice or data.

Volume - A single item of magnetic disk or tape storage containing a directory of files stored on it.

Wideband - A high capacity networking technique capable of supporting various types of simultaneous communication channels.

Winchester Disk - A rigid non-removable sealed magnetic disk unit, more compact and reliable than floppys. Capable of storing 5-100 megabytes of information.

Word Processing System - Refers to the hardware, software and procedures to carry out writing, editing and filing textual material.

Word Wrap - The automatic movement of text exceeding the right margin's next line during typing. Increases typing speed since margin decisions are made automatically

Public Access Bulletin Boards

BOARD NAME	NUMBER
RCP/M RBBS Software Tools, Austrailia	(02 997 1836
ABBS Apple Group N.J., Piscataway, NJ	201 968 1074
ABBS Apple-Mate, New York, NY	201 864 5345
ABBS CCNJ, Pompton Plains, NJ	201 835 7228
ABBS Livingston, NJ	201 994 9620*2
ABBS Saddlebrook, NJ	201 843 4563
A-C-C-E-S-S Wyckoff, NJ	201 891 7441*2
CONFERENCE-TREE ?, New Jersey	201 627 5151
DIAL-YOUR-MATCH #14	201 272 3686-s
FORUM-80 Linden, NJ	201 486 2956*2
PMS - Rutgers Univ. Microlab, Piscataway, NJ	201 932 3887
PMS - Shrewsbury, NJ	201 747 6768
RATS Systems #1	201 887 8874
RCP/M MCBBS Ken Stritzel, Flanders, NJ	201 584 9227*2
RCP/M RBBS Ocean, NJ	201 775 8705
RCP/M RBBS Rutgers, New Brunswick, NJ	201 932 3879*2
Aphrodite-E	201 790 5910-s
New Jersey TELECOM #1	201 635 0705*2
ARMUDIC Washington, DC #1	202 276 8342
BULLET-80 Danbury, CT #1	203 744 4644
ABBS Apple Crate I, Seattle, WA	206 935 9119
DIAL-YOUR-MATCH #16	206 256 6624-s
Mini-Bin Seattle, WA	206 762 5141*2
DIAL-YOUR-MATCH #26, Clovis, CA	209 298 1328-s
BULLET-80 New York, NY	212 740 5680*2
CONNECTION-80 Woodhaven, NY	212 441 3755*2
NET-WORKS New York, NY	212 410 0949
PMS - McGraw-Hill Books, New York, NY	212 997 2488
TCBBS B.A.M.S. New York, NY	212 362 1040*2
TCBBS Leigh's Computer World, NY	212 879 7698
TCBBS W.E.B.B. New York, NY #1	212 799 4649
Bronx BBS, NY	212 933 9459
COMM-80 Queens, NY	212 897 3392*2
Nybbles-80 NY	212 626 0375
SISTER Staten Island, NY	212 442 3874*2
ABBS Computer Conspiracy, Santa Monica, CA	213 829 1140
ABBS Pacific Palasades, Los Angeles, CA	213 459 6400
CONFERENCE-TREE #4, Santa Monica, CA	213 394 1505
CONFERENCE-TREE Kelp Bed, Los Angeles, CA	213 372 4800
DIAL-YOUR-MATCH #1	213 842 3322-s
DIAL-YOUR-MATCH #4	213 783 2305-s
DIAL-YOUR-MATCH #9	213 345 1047-s
DIAL-YOUR-MATCH #11	213 242 1882-s
DIAL-YOUR-MATCH #22	213 990 6830-s
HBBS San Fernando Valley	213 366 4837
NET-WORKS Coin Games, Los Angeles, CA	213 336 5535

NET-WORKS Computer World, Los Angeles, CA. .		213	859	0894*2
NET-WORKS Encino, CA.		213	345	3670
NET-WORKS Softworx, West Los Angeles, CA.		213	473	2754
PASBBS Bellflower, CA.		213	531	1057
PASBBS Torrance, CA.	#1	213	516	7089*2
PMS - Los Angeles, CA.		213	334	7614*2
PMS - O.A.C., Woodland Hills, CA.		213	346	1849*2
RCP/M CBBS Pasadena, CA.		213	799	1632*2
RCP/M RBBS Sofwaire Store, Los Angeles, CA. .		213	479	3189*2
All Night BBS.	!	213	564	7636
BBS B.R , Los Angeles, CA.		213	394	5950*2
Computer Connection.	!	213	657	1799
Datamate, Canoga Park, CA.	#1	213	998	7992-s
Dragon's Game System.	(pass=DRAGON) . . .	213	428	5206
Greene Machine Fricaseed Chicken, Arcadia, CA	!	213	445	3591*2
Kluge Computer.	$&	213	947	8128*2
Long Beach Community Computer.		213	591	7239*2
Oracle North Hollywood, CA.		213	980	6743-s
ABBS Dallas Info Board.		214	248	4539
ABBS Teledunjon III, Dallas, TX.		214	960	7654
BULLET-80 Hawkins, TX		214	769	3036
NET-WORKS Apple Grove, Dallas, TX.		214	644	5197
NET-WORKS Dallas, TX.		214	361	1386*2
NET-WORKS Eclectic Computer Sys., Dallas, TX		214	239	5842
NET-WORKS Hacker-net, Dallas, TX		214	824	7160
RCP/M CBBS Dallas, TX	!	214	931	8274
BBS-80 DALTRUG, Dallas, TX		214	235	8784*2
BULLET-80 Langhorne, PA		215	364	2180
COMNET-80 North Wales, PA.		215	855	3809
RCP/M RBBS Allentown, PA.		215	398	3937*2
Hermes-80 Allentown, PA		215	434	3998
Lehigh Press BB, PA.	#1	215	435	3388
ABBS Akron Digital Group, Akron, OH		216	745	7855*2
BULLET-80 Chesterland, OH.		216	729	2769
COMNET-80 Akron, OH.	&	216	645	0827*2
PMS - Massillon, OH.		216	832	8392*2
PMS - RAUG, Akron, OH		216	867	7463*2
BBS Computer Applications Co., Poland, OH . .		216	757	3711
BULLET-80 Springfield, IL.		217	529	1113
NET-WORKS C.A.M.S., Decatur, IL.		217	429	5541
ABBS Computer Crossroads, Columbia, MD		301	730	0922
A-C-C-E-S-S Annapolis, MD		301	267	7666*2
ARMUDIC Computer Age, Baltimore, MD.		301	587	2132
CBBS CPEUG/ICST Gaithersburg, MD.		301	948	5717
CONNECTION-80 Gaithersburg, MD.		301	840	8588*2
NET-WORKS COMM Center NW3NAGAD, Laurel, MD		301	953	3341
PMS - Baltimore, MD.		301	764	1995*2
PMS - Ellicott City, MD.		301	465	3176
PMS - Pikesville, MD.		301	653	3413
PSBBS Baltimore, MD.		301	994	0399*2
RCP/M RBBS Bethesda, MD		301	229	3196
RCP/M RBBS Laurel, MD.		301	953	3753*2
Remote Northstar NASA, Greenbelt, MD		301	344	9156
HEX Silver Spring, MD	%	301	593	7033*2
HBBS Denver, CO.		303	343	8401*2

RCP/M CUG-NOTE, Denver, CO	303	781	4937*2
RCP/M RBBS Arvada Elect.,Colorado Springs,CO	303	634	1158*2
RCP/M RBBS Boulder, CO	303	499	9169
Remote Northstar Denver, CO	303	444	7231
ABBS Byte Shop, Miami, FL	305	261	3639
AMIS APOGEE Miami, FL	305	238	-1231-r
CONNECTION-80 Winter Garden, FL	305	894	1886*2
TRADE-80 Ft Lauderdale, FL #1	305	525	1192
BBS Homestead, FL	305	246	1111
NET-WORKS MAGIE, Galesburg, IL	309	342	7178
ABBS CODE, Glen Ellyn IL	312	537	7063*2
ABBS Gamemaster, Chicago, IL	312	475	4884*2
ABBS Illini Microcomputer, Naperville, IL	312	420	7995
AMIS Chicago, IL	312	789	3610*2
MCMS C.A.M.S. Chicago, IL #1	312	927	1020*2
MCMS L A.M.S. Round Lake, IL	312	740	9128
MCMS Message-82, Chicago, IL	312	622	4442*2
MCMS WACO Hot Line, Schaumburg, IL (pvt)	312	351	4374*2
NET-WORKS Chipmunk, Hinsdale, IL	312	323	3741*2
NET-WORKS CLAH, Arlington Heights, IL	312	255	6489
NET-WORKS North Parks, Chicago, IL	312	745	0924
PBBS Co-operative Comp Svc, Palatine, IL	312	359	9450*2
PMS - Chicago, IL	312	373	8057*2
PMS - Downers Grove/SRT, Downers Grove, IL !	312	964	6513
PMS - I.A.C., Lake Forest, IL	312	295	6926*2
RCP/M IBM PC, Niles, IL !	312	259	8086
RCP/M Logan Square, Chicago, IL	312	252	2136
RCP/M NEI, Chicago, IL	312	949	6189
RCP/M Palatine, IL &	312	359	2553*2
RCP/M RBBS Hyde Park, IL	312	955	4493
MARS/RP Rogers Park, IL	312	743	8176*2
NESSY Chicago, IL #1	312	773	3308
PET BBS Commodore, Chicago, IL	312	397	0871*2
Scream Machine !	312	680	9613-s
ABBS Detroit, MI	313	477	4471
AMIS A.R.C A.D.E. Sterling Heights, MI	313	978	8087*2
AMIS M.A.C.E. Detroit, MI #1	313	868	2064*2
BULLET-80 Waterford, MI !	313	683	5076*2
RCP/M MCBBS TCBBS Dearborn, MI	313	846	6127*2
RCP/M RBBS Pontiac, MI	313	338	8595
RCP/M RBBS Southfield, MI	313	559	5326*2
RCP/M RBBS Westland, MI	313	729	1905-r
Davy Jones Locker !	313	764	1837
Treasure Island !	313	547	7903
Twilight Phone !	313	775	1649*2
Westside Download, Detroit, MI	313	533	0254
ABBS Century Next Computers, St. Louis, MO	314	442	6502
NET-WORKS St. Louis, MO	314	781	1308
PET BBS Commodore Comm., Lake St. Louis, MO	314	625	4576*2
Midwest, St. Louis, MO	314	227	4312-s
FORUM-80 Wichita, KA &	316	682	2113*2
NET-WORKS Greenfield, IN	317	326	3833*2
ONLINE Indianapolis,IN.(ID#=GUES, pswd=pass)	317	787	9881*2
PMS - Indianapolis, IN	317	787	5486*2
PET BBS AVC Comline, Indianapolis, IN	317	255	5435*2

FORUM-80 Shreveport, LA	318	631	7107*2
ABBS Apple-Med, Iowa City, IA	319	353	6528
CBBS Cedar Rapids, IA	319	364	0811
CBBS London, England (European standard) (0 4)	399	2136	
NET-WORKS Computer City, Providence, RI	401	331	8450*2
DIAL-YOUR-MATCH #23, Omaha, NE !	402	571	8942-s
TRADE-80 Omaha, NE	402	292	6184
ABBS AGS, Atlanta, GA	404	733	3461*2
ABBS Baileys Computer Store, Augusta, GA	404	790	8614
ABBS #X, Atlanta, GA	404	256	1549
BULLET-80 Fayetteville, GA	404	461	9686
Remote Northstar Atlanta, GA #1	404	926	4318*2
Telemessage-80, Atlanta, GA	404	962	0616
AMIS GRAFEX Cupertino, CA	408	253	5216
BULLET-80 San Jose, CA	408	241	0769
RCP/M RBBS San Jose Oxgate, San Jose, CA	408	287	5901*2
RCP/M Silicon Valley, CA	408	246	5014*2
CBBS PACC, Pittsburgh, PA	412	822	7176*2
? (Western Massachusettes)	413	637	3515
ABBS Colortron Computer, WI	414	637	9990*2
CBBS MAUDE Milwaukee, WI	414	241	8364*2
CONNECTION-80 Canopus, Milwaukee, WI	414	281	0545*2
CONNECTION-80 Vanmil, Milwaukee, WI	414	271	7580*2
PET BBS S.E.W.P.U.G., Racine, WI	414	554	9520*2
BBS SUE Milwaukee, WI	414	483	4578
Big Top Games System, Milwaukee, WI	414	259	9475
ABBS Computerland, Fremont, CA	415	794	9314
ABBS Hayward, CA	415	881	5662
CBBS Lambda, Berkeley, CA	415	658	2919-s
CBBS Proxima, Berkeley, CA	415	357	1130
CONNECTION-80 Fremont, CA	415	651	4147*2
CONFERENCE-TREE #3, Hayward, CA	415	538	3580
DATABOARD-80, Atherton, CA	415	367	7638*2
DIAL-YOUR-MATCH #17 !	415	991	4911-s
RCP/M RBBS DataTech 001, San Carlos, CA #1$&	415	595	0541*2
RCP/M RBBS DataTech 006, San Francisco, CA	415	563	4953
RCP/M RBBS Larkspur, CA	415	461	7726*2
RCP/M RBBS Marin County, CA	415	383	0473*2
RCP/M RBBS Piconet Oxgate, Mountain View, CA	415	965	4097*2
Blue BOSS IBM PC, Berkeley, CA !	415	845	9462*2
MRCBBS !	415	968	1093-s
Sunrise Omega-80, Oakland, CA	415	452	0350
System/80 San Leandro, CA	415	895	0699
NET-WORKS Toronto, Ontario, CN !	416	445	6696*2
RCP/M HAPN Hamilton, Ontario, CN	416	335	6620*2
RCP/M Mississauga HUG, Toronto, Ont., CN $&	416	826	5394*2
PET BBS PSI WordPro, Ontario, CN #1	416	624	5431*2
PET BBS TPUG, Toronto, Ontario, CN	416	223	2625*2
ABBS ABACUS II, Toledo, OH	419	865	1594
ABBS Computer Store, Toledo, OH	419	531	3845
FORUM-80 Hull, England (011)	44	2	859169
CONNECTION-80 Little Rock, AS	501	372	0576
PMS - Ft. Smith Comp. Club, Ft. Smith, AK	501	646	0197
CBBS NW, Portland, OR	503	646	5510*2
CONNECTION-80 PAUG, Portland, OR	503	281	7653

RCP/M Chuck Forsberg, OR		503 621 3193
OARCS Portland, Oregon		503 641 2798
ABBS Baton Rouge, LA		504 291 1360
CBBS Baton Rouge, LA		504 273 3116*2
Baton Rouge Data System, Baton Rouge, LA		504 926 0181
ABBS Electro-Mart, Spokane, WA		509 534 2419*2
CBBS Corpus Christi, TX		512 855 1512
CONFERENCE-TREE Victoria, TX		512 578 5833
FORUM-80 San Antonio, TX		512 340 6720
NET-WORKS Sparklin' City, Corpus Christi, TX		512 882 6569
Bathroom Wall BBS, San Antonio, TX		512 655 8143
SATUG BBS, San Antonio, TX		512 494 0285
NET-WORKS Dayton, OH		513 223 3672
PMS - Cincinnati, OH		513 671 2753
XBBS Hamilton, OH		513 863 7681*2
CONNECTION-80 Laval BELE, Laval, Quebec, CN		514 622 1274*2
ONLINE Computerland, Montreal, Quebec, CN		514 931 0458*2
Distra-Soft, Montreal, Quebec, CN		514 327 5764*2
NET-WORKS Computer Emporium, Des Moines, IA		515 279 8863
ABBS Pirates Cove, Long Island, NY		516 698 4008
CBBS LICA LIMBS, Long Island, NY		516 561 6590*2
CBBS Long Island, NY		516 334 3134*2
CONNECTION-80 Centereach, NY		516 588 5836
CONNECTION-80 Great Neck, NY		516 482 8491*2
NET-WORKS Pirate's Trek	!	516 627 9048
Adventure BBS		516 621 9296
CONNECTION-80 Lansing, MI		517 339 3367
Capital City BBS, Albany, NY		518 346 3596*2
Remote Apple Jackson, MS		601 992 1918*2
ABBS Phoenix, AZ		602 898 0891
A-C-C-E-S-S Phoenix, AZ	#1	602 996 9709*2
A-C-C-E-S-S Scotsdale, AZ		602 998 9411*2
FORUM-80 Nashua, NH		603 882 5041
NET-WORKS Portsmouth, NH		603 436 3461
Software Referral Service	!	603 625 1919
ABBS Vancouver, B.C.		604 437 7001
CBBS Prince George, B.C., Canada		604 562 9515
RCP/M SJBBS Johnson City, NY		607 797 6416
AMIS Magic Lantern, Madison, WI		608 251 8538
ABBS Turnersville, NJ		609 228 1149
ABBS Calvary Mission Church, Mnpls, MN		612 471 0252-r
CBBS Richfield ?		612 423 5016
CONFERENCE-TREE Minneapolis, MN		612 854 9691
MCMS NC Software, Minneapolis, MN		612 533 1957*2
PMS - Minneapolis, MN		612 929 6699*2
ABBS Compumart, Ottawa, Ontario, Canada		613 725 2243
BULLET-80 Ironton, OH		614 532 6920
RCP/M CBBS Columbus, OH		614 272 2227*2
Applecrackers, Columbus, OH	!	614 475 9791*2
Ohio Valley BBS	!	614 423 4422
ABBS Computer Room, Kalamazoo, MI		616 382 0101
AMIS G.R.A.S.S. Grand Rapids, MI		616 241 1971*2
CONNECTION-80 W. Mich. Micro Group, MI		616 457 1840*2
AMIS Starbase 12 Philadelphia, PA		617 876 4885
BULLET-80 Boston, MA	&	617 266 7789*2

CBBS Boston, MA	617	646	3610*2
CBBS Lawrence General Hospital, Boston, MA	617	683	2119
CBBS MicroStar, Worcester, MA !	617	752	7284
DIAL-YOUR-MATCH #18 !	617	334	6369-s
FORUM-80 Westford, MA	617	692	3973
NET-WORKS Pirate's Harbor, Boston, MA	617	720	3600
RCP/M MCBBS Superbrain, Lexington, MA $&	617	862	0781*2
Boston Information Exchange, Boston, MA &	617	423	6985*2
New England Comp. Soc., Maynard, MA	617	897	0346
NET-WORKS Granite City, IL	618	877	2904
NET-WORKS Warlock's Castle St. Louis, MO	618	345	6638
CONNECTION-80 Escondido, CA	619	746	6265
ONLINE Saba, San Diego, CA	619	692	1961*2
ONLINE Santee, CA (ID#=GUEST, pswd=PASS)	619	561	7271*2
PMS - Computer Merchant, San Diego, CA	619	582	9557
PMS - El Cajon, CA !	619	579	0553
PMS - Escondido, CA	619	746	0667
PMS - Lakeside, CA. (type PMS to activate)	619	561	7271*2
PMS - Mesa Systems, San Diego, CA	619	271	8613*2
PMS - Santee, CA #1	619	561	7277*2
RCP/M RBBS San Diego, CA $&	619	273	4354*2
NET-WORKS Armadillo, Grand Forks, ND	701	746	4959
PMS - Century 23, Las Vegas, NV	702	878	9106*2
ABBS Software Sorcery, Herndon, VA	703	471	0610
CBBS AMRAD, Washington, DC	703	734	1387*2
FORUM-80 Prince William County, VA	703	670	5881*2
Carrier 2 Alexandria, VA	703	823	5210
C-HUG Bulletin Board, Fairfax, VA	703	360	3812*2
Switchboard, Alexandria, VA	703	765	2161*2
RCP/M RBBS Napa Valley, CA	707	253	1523??
BULLET-80 Holstein, IA	712	368	2651
ABBS Madam Bokeatha Society, Houston, TX	713	455	9502
ABBS Youngs Elect Svc., College Station, TX	713	693	3462*2
BULLET-80 Houston, TX	713	331	2599
DIAL-YOUR-MATCH #12, Houston, TX !	713	556	1531-s
DIAL-YOUR-MATCH #24, Houston, TX !	713	783	4136-s
PMS - Gulfcoast, Freeport, TX	713	233	7943*2
RCP/M RBBS Houston, TX !	713	497	5433
Armadillo Media Services, Houston, TX !	713	444	7098
Compuque-80, Houston, TX !	713	444	7041*2
Micro Design, Houston, TX !	713	864	4672
PMBBS !	713	441	4032
Weekender, Houston, TX !	713	492	8700
Zachary*Net, Houston, TX !	713	933	7353*2
ABBS Newport Beach, CA	714	645	5256*2
BULLET-80 Laguna Hills, CA !	714	770	5052
BULLET-80 Orange County, Anaheim, CA	714	952	2110
COMNET-80 Riverside, CA &	714	359	3189
RCP/M RBBS GFRN Dta Exch. Garden Grove, CA $&	714	534	1547*2
Dimension-80 Orange, CA	714	974	9788
IDBN Info-Net, Costa Mesa, CA	714	545	7359
Irvine Line, Irvine, CA !	714	551	4336
North Orange County Computer Club	714	633	5240
OCTUG Orange County, Garden Grove, CA	714	530	8226
Orange County Dta Exchange, Garden Grove, CA	714	537	7913

PIG-STY Costa Mesa, CA.....! 714 545 4648
RACS V Fullerton, CA.....! 714 524 1228
PIG-STY Costa Mesa, CA.....! 714 545 4648
CBBS RAMS, Rochester, NY..... 716 244 9531
RCP/M RBBS Rochester, NY..... 716 223 1100*2
BULLET-80 Clarks Summit, PA..... 717 586 2112
ABBS Vermont, Essex Junction, VT..... 802 879 4981*2
ST80-CC Lance Micklus, Inc. Burlington, VT.#1 802 862 7023*2
FORUM-80 Charleston, SC..... 803 552 1612*2
Compusystems, Columbia, SC..... 803 771 0922
Remote Northstar Santa Barbara, CA..... 805 964 4115
ABBS Computer Corner, Amarillo, TX..... 806 355 5610
NET-WORKS Computer Market, Honolulu, HI..... 808 521 7312
NET-WORKS Hawaii..... 808 521 7312
NET-WORKS Hawaii Connection, Honolulu, HI.... 808 423 1593*2
CBBS Bloomington, IN..... 812 334 2522
CONNECTION-80 Tampa, FL..... 813 977 0989
FORUM-80 Wild goose board, Tampa, FL..... 813 988 7400
RCP/M RBBS Computerized Services, Tampa, FL.. 813 988 7400*2
Remote Northstar Largo, FL..... 813 535 9341*2
Alpha, Tampa, FL..<acct#=ABCD00, pwd=TRYIT>.. 813 251 4095*2
Apollo's Chariot, Apollo, FL..... 813 645 3669
Bradley Computer BBS 813 734 7103
BSBB Tampa, FL..... 813 885 6187
Micro Informer..... 813 884 1506
TECOM-80, Tampa, FL..... 813 839 6746
RCP/M CUG-NODE, PA State College..... 814 238 4857*2
TRADE-80 Erie, PA..... 814 898 2952*2
CONFERENCE-TREE Computerland, Honolulu, HI... 800 487 2001*2
LITHO/NET..... 800 831 6964
ABBS Vermont, Essex Junction, VT..... 802 879 4981*2
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TRADE-80 Erie, PA..... 814 898 2952*2
MCMS J.A.M.S. Lockport, Ill..... 815 838 1020*2
NET-WORKS ABC, Kansas City, Mo..... 816 483 2526
FORUM-80 Wichita, Ka..... 817 855 3916

ABBS Computer Lab, Memphis, Tn	901 761 4743
FORUM-80 Medical, Memphis, Tn	901 276 8196*2
ABBS Fort Walton Beach, Destin, Fl	904 243 1257
CONFERENCE-TREE Anchorage, AK	907 344 5251
DIAL-YOUR-MATCH #3	912 233 0863-s
PMS - Apple Bits, Kansas City, Mo	913 677 1299*2
RCP/M RBBS Woodstock, NY	914 679 8734*2
NET-WORKS	914 725 4060
FORUM-80 El Paso, Tx	915 755 1000*2
RCPM RBBS El Paso, Tx	915 533 2202*2
CONNECTION-80 Tulsa, OK	918 747 1310*2
DIAL-YOUR-MATCH #20	919 362 0676-S

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- Organizational Policy
- Implementation Strategies
- Selection and Acquisition Guidelines
- Data Communications
- Personal Computer Networking
- Applications Software

with hands on classes available for:

- Data Base Management using DBASEII
- Calculation Spreadsheet Analysis
- Word Processing
- P.C. to Mainframe Communications

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Dr. Stern has a PhD in Chemical Engineering from the University of Rhode Island and is the author of the forthcoming book, Word Processing and Beyond. His research has been funded by The Atomic Energy Commission, The Ford Foundation, The National Endowment for the Arts, as well as many other private and public foundations.

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